

冲突与和谐

羌塘地区人与野生动物生存研究

Competition and Coexistence

Human-Wildlife Conflict In the Chang Tang Region of Tibet

达瓦次仁

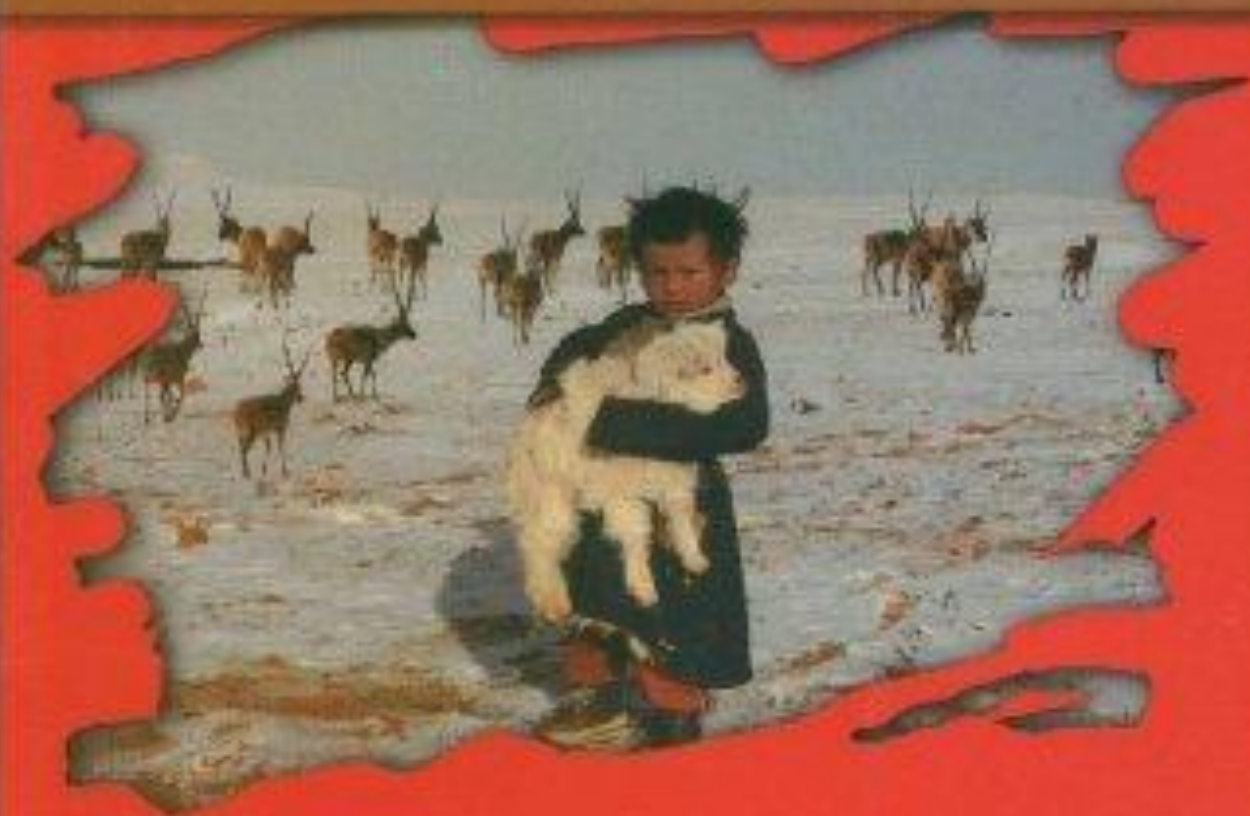
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去年有_____次。

8. 你认为在你的地区内雪豹的相对数量是怎样的:

A) 现今: 稀少/比较普遍/很多。

B) 10 年以前: 稀少/比较普遍/很多。

9. 你认为在你的地区内雪豹的数量是在增加还是在减少?

10. 对于雪豹来说, 威胁有哪些:

A) 人们猎杀它们为了保护:

家畜

财产(比如, 帐篷或房屋)

自己

B) 人们猎杀它们为了出售、赚钱

C) 缺少食物

D) 严酷的气候

E) 其它

11. 雪豹与雪豹之间相隔有多远?

12. 在开阔的草场上曾否看到雪豹和雪豹的踪迹?

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May 2007
WWF China-Tibet Program

Contents

Contents	(133)
Foreword	(136)
Acknowledgements	(141)
Part I. Introduction	(142)
1.1 The Chang Tang of the northern Tibet Autonomous Region	
1.2 Human-wildlife conflict in the region of the Seling Lake and southern Chang Tang nature reserves	
1.3 The human - wildlife conflict survey methodology	
Part II. Socio-Economic Status of Surveyed Herding Households	(154)
2.1 Household type	
2.2 Living arrangement	
2.3 Self-assessed economic status	
Part III. Analysis of Wildlife Conflict by Household Socio-Eco- nomic Status	(165)
3.1 Overall human-wildlife conflict	
3.2 Wildlife conflict by household type and county	
3.3 Wildlife conflict by living arrangement and county	
3.4 Wildlife conflict by self-assessed economic status and county	
Part IV. Analysis of Wildlife Conflict by Species and Household Socio-Economic Status	(172)

4.1 Overall wildlife conflict by species	
4.2 Wildlife conflict by species and county	
4.3 Wildlife conflict by species and household type	
4.4 Wildlife conflict by species and living arrangement	
4.5 Wildlife conflict by species and self-assessed economic status	
4.6 Wildlife conflict by species and time period	
Part V. Analysis of Human-Bear Conflict	(189)
5.1 Human-bear conflict by county and surveyed socio-economic factors	
5.2 Human-bear conflict by time period and county	
5.3 Bear sightings by herders	
5.4 Herders' views on bear ecology	
5.5 Selected recent reports of bear conflict	
5.6 Killing of Tibetan brown bears in the Chang Tang reserve	
5.7 Section summary	
Part VI. Analysis of Wildlife Conflict with Other Species	(210)
6.1 Snow leopard	
6.2 Wolf	
6.3 Fox	
6.4 Lynx	
6.5 Grazing competition	
Part VII. Herders' Views on Human-Wildlife Conflict	(248)
Part VIII. Additional Conflict Data and Analysis	(255)
8.1 County human-wildlife conflict data	
8.2 Additional human wildlife conflict investigations	

Part IX. Other Conservation Challenges in the Chang Tang	(265)
9.1 Illegal poaching	
9.2 Destructive economic development	
9.3 Lack of funding for reserve management	
Part X. Key Survey Findings and Discussion	(271)
10.1 Key findings	
10.2 Discussion	
Part XI. Recommendations	(281)
11.1 Mitigative actions	
11.2 Preventative actions	
11.3 Administrative actions	
11.4 Scientific research	
Part XII. Conclusions	(284)
References	(287)
Appendices	(293)
Appendix 1: List of Key Mammal and Bird Species Found in the Chang Tang	
Appendix 2: Human-Wildlife Conflict Survey Questionnaire	
Appendix 3: English, Chinese, and Tibetan Place Names	

Foreword

After many thousands of years living at the mercy of nature, over the past few centuries humans have become the unquestioned masters of the natural world. Today there is no species of animal on earth that poses a threat to mankind's continued existence, however, mankind controls the fate of all large species of wild animals in existence today, and we continue to push many of these species towards the brink of extinction by our actions. It should be obvious that mankind's attitude towards wildlife is the decisive factor for the continued survival of many species in the wild, and that the primary purpose for the protection and management of wildlife is to preserve the ecosystems and environment upon which our own survival as a species is dependent.

As our planet's human population continues to increase at an unprecedented rate as a result of previously undreamt of achievements in the agricultural and medical sciences, continually expanding poor rural populations are coming into increasing conflict with the planet's rapidly dwindling populations of large fauna. From wolves and jaguars in the new world to elephants, rhinos, lions and tigers in the old world, large species of wild fauna are increasingly

competing directly with humans for living space and sustenance. All too often the result of this competition is the slaughter of wildlife by humans, and the replacement of a landscape's wild species by members of our own, providing yet another indication of our own inability to live in harmony with nature and adequately protect the natural world we inherited from our forefathers.

Sadly, even in as barren and sparsely populated a land as Tibet's Chang Tang wilderness, which has only been permanently inhabited by humans for the past 45 years or so, human-wildlife conflict is posing a grave threat to the continued existence of the region's large fauna, in particular the Tibetan brown bear, snow leopard, wild yak, Tibetan wild ass, Tibetan antelope, and Tibetan gazelle. Human-wildlife conflict is now a common occurrence in the Chang Tang, and elsewhere in Tibet, and poses a complex problem for conservationists trying to protect large fauna. This conflict takes on four primary forms in the Chang Tang region: 1) killing of domestic livestock in corrals and on open pastures by Tibetan brown bears, snow leopards, and other predators, 2) Tibetan brown bears badly damaging herders' cabins and tents in search of food, 3) loss of important grass resources to large herds of widely migrating wild ungulates, in particular the Tibetan wild ass, possibly leading to winter starvation of livestock, and 4) driving off

of domestic female yaks by wild yak bulls in search of herms. These forms of conflict can inflict devastating economic losses on the Chang Tang's poor nomadic herders, and at times result in severe injury or even death of herders themselves. Not surprisingly, when asked, many herders in the Chang Tang express great ill-will towards the wild animals they share the northern Tibetan steppes with.

The multiple-use Chang Tang and Seling Lake Nature Reserves were created in 1993 to protect the unique assemblage of large fauna inhabiting the high-altitude steppe grasslands of northern Tibet. Prior to creation of the reserves, many species were heavily hunted for meat and sale of parts. Since creation of the reserves, however, killing of wildlife by subsistence hunters and commercial poachers has declined, only to spawn a new wildlife problem, that of widespread human-wildlife conflict. With human, livestock, and wildlife populations in the reserves all increasing, and animals apparently emboldened by reserve-wide hunting bans, all forms of human-wildlife conflict have surged rapidly since 2001.

In April of 2006, the authors conducted a wildlife conflict survey of 300 herding households in Nagchu Prefecture's Shenzha, Tsonyi, and Nyima Counties. Results showed that 87 percent of households had experienced some form of wildlife conflict since 1990. The Tibetan brown bear

was the largest source of wildlife conflict, affecting 49 percent of surveyed households, followed by grazing competition conflict, which affected 36 percent of surveyed households, and snow leopard conflict, which affected 24 percent of surveyed households. Type and frequency of wildlife conflict problems cut across all three surveyed socio-economic factors - residence type, size of living group, and economic status/herd size - and was primarily a function of location. A break down of incidence of human-wildlife conflict into three 5 to 6-year time periods between January 1990 and April 2006 revealed dramatic increases in conflict occurring since 2001. When compared to the 1990-1995 period, the incidence of conflict today ranged from 2.6 times higher for fox conflict to 5.5 times higher for conflict with snow leopards, while there was a 4.6-fold increase in the occurrence of bear conflict. From second-hand accounts and wildlife remains confiscated from herders, it is now believed that retaliatory killing of wildlife rivals commercial poaching as the greatest threat to the continued existence of the Chang Tang region's large fauna. Human-wildlife conflict reduction strategies and wildlife conservation education programs must be devised and implemented in order to halt the retaliatory killing of wildlife by nomadic herders in the Chang Tang. This short book discusses the findings of WWF's 2006 Chang Tang Human-Wildlife Conflict Study in detail, and it

is hoped that this work will inspire readers to make their own contribution towards protecting the Tibetan Plateau's threatened large fauna.

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Part I. Introduction

1.1 The Chang Tang of the Northern Tibet Autonomous Region

The Chang Tang of the Tibet Autonomous Region (TAR) is a barren region of sparsely populated, high altitude steppe grasslands that cover roughly the northern half of the TAR and extend into western Qinghai Province. Known locally as the “great northern void,” the rolling expanses of the northern TAR’s Chang Tang region have an average elevation of about 4500 m and form one of the most remote and inhospitable places on earth. Remarkably, the region was never permanently inhabited until the latter half of the 20th Century, and as a result much of the vast steppes of the northern TAR have been preserved as one of the world’s last great relatively untouched grassland ecosystems (Schaller 1998a, Fox and Tsering 2005). Despite the harsh high altitude climate and scant forage, the region harbors a unique assemblage of large wild mammals, which until recently numbered hundreds of thousands of Tibetan antelope, Tibetan gazelle, and Tibetan wild ass, as well as tens of thousands of wild yak and blue sheep – of which the Tibetan antelope, Tibetan wild ass, and wild yak are en-

demic to the Tibetan Plateau.

However, since the mid 1950s, the construction of roads across the northern TAR has led to increased access to the Chang Tang region by commercial hunters and the mass slaughter of these once vast herds of wild ungulates (Tsering and Namgyal 2004). As a result, the total population of the above five species of wild ungulates has probably fallen by more than 90 percent, with antelope having been relentlessly hunted to supply wool for the “shahtoosh” shawl trade, and wild ass, wild yak, gazelle and blue sheep having been hunted for meat (Schaller 1998b). Consequently, the situation of the Chang Tang’s remaining herds of wild ungulates is beginning to resemble that of the buffalo on the American Great Plains at the end of the 19th century, when buffalo herds once numbering in the tens of millions were hunted to the brink of extinction.

In addition to hunters, the construction of roads has been accompanied by an influx of herders to previously uninhabited areas of the northern TAR’s Chang Tang region. Small numbers of nomads have roamed the northern Chang Tang’s vast steppes seasonally for centuries, surviving in the harsh environment by employing herding practices that were based on mobility. The migratory system of animal husbandry that evolved among these early Tibetans was highly sensitive to environmental conditions, and led to an

ecologically-sound pattern of land use, where nomads moved their yaks, cows, sheep, goats, and horses between summer and winter pastures each year, allowing for the annual regeneration of both pasture types (Tsering 2004).

However, since the 1960s, as a result of increasing population pressure and government policies to increase livestock production, large numbers of nomadic herders from throughout the Tibetan cultural area have migrated to the northern TAR with their herds, settling previously uninhabited lands and constructing the first permanent settlements in the northern TAR's Chang Tang region. Yet in spite of the appearance of towns and villages on the landscape, the nomadic herders of northern TAR continue to live a largely subsistence existence today, surviving under the harsh conditions on a staple diet of barley flour or *tsampa*, yak meat, milk, and dairy products such as butter and cheese, with surplus meat and dairy products being bartered for grain. These nomads also continue to use yak and sheep wool for making tents, ropes and clothes, and live an extremely hard life that has changed little in the past few centuries (Goldstein and Beale 1990).

Due to the settlement of the area over the past four decades, the most productive grazing lands throughout the southern half of the TAR's Chang Tang region are now permanently occupied by herders and their livestock, which has

caused the large scale displacement of wild ungulates to the unoccupied, more marginal habitat of the arid northern Chang Tang (Tsering and Namgyal 2004, Fox and Bardsen 2005). The growing number of herders occupying wildlife habitat has also, not surprisingly, led to increasingly frequent occurrences of human-wildlife conflict, often resulting in the retaliatory killing of wildlife by herders. This conflict includes both predator attacks on livestock and large herds of wild ungulates competing with domestic livestock for limited grazing resources. Consequently, retaliatory killing of wildlife by nomads is now believed to rival commercial poaching as the biggest threat to wildlife in the Chang Tang.

In order to halt the slaughter of the Chang Tang's predators and dwindling herds of wild ungulates by commercial poaching rings, subsistence hunters, and destitute herders protecting their property and livelihoods, in 1993 the vast Chang Tang Provincial Nature Reserve was created, which in 2001 was elevated to the status of a national-level nature reserve. Today, the Chang Tang National Nature Reserve has an area of 298,000 km² (113,550 mi.²), about the size of the American state of Arizona, which covers the entire northwest quarter of the TAR (Map 1, TFB 1999, Fox and Tsering 2005). The reserve is a designated International Union for the Conservation of Nature (IUCN) Class V multi-use protected area where economic activities such as

grazing of domestic livestock are allowed, and even until recently mining, but hunting of wildlife is strictly prohibited. In 1993 the Chang Tang reserve was home to a human population of about 22,000, primarily semi-nomadic herders, who owned an estimated 1.4 million head of livestock (Schaller et al. 2005, Fox and Tsering 2005).

In addition, in 1993 the government of the TAR established the Shenzha Nature Reserve just south of the Chang Tang reserve, which in 2002 was expanded and renamed the Seling Lake Black-Necked Crane National Nature Reserve. The new Seling reserve has an area of 18,936 km² (7,310 mi.²), about the size of the American states of Connecticut and Rhode Island combined, and is somewhat ecologically distinct from the Chang Tang reserve in that it protects numerous large lakes and wetlands that provide important habitat for cranes and other water fowl in Shenzha, Nyima, Nagchu, Amdo and Pelgun Counties of the TAR's Nagchu Prefecture (TFB 2003, Maps 1 and 2)

1.2 Human-Wildlife Conflict in the Region of the Seling Lake and Southern Chang Tang Nature Reserves

Historically, subsistence hunting has been an important source of income for the Chang Tang's nomadic herders, providing meat, protection for livestock, and furs and parts to barter with traders for other necessities. However

the unsustainable slaughter that led to the precipitous fall of wildlife populations in the Chang Tang did not begin until the first roads were opened across the Chang Tang in the 1960s, which were accompanied by the introduction of motor vehicles and modern firearms. Although slaughter of Tibetan antelope and other wildlife species for the commercial sale of wool and meat was rampant prior to the mid-1990s, through the efforts of the government and international conservation organizations, wildlife populations in the Chang Tang region have now stabilized, and the populations of most threatened species are believed to be slowly increasing - though commercial poaching in the Chang Tang continues (Schaller et al. 2005).

Although the campaign to confiscate all firearms owned by the residents of the Chang Tang and increased ranger patrols have born excellent results in protecting wildlife, the human population of many areas of the Chang Tang has doubled since the 1960s, in large part due to general improvement of rural healthcare services and investment in livestock development (e.g. see Schaller et al. 2005). And as young herders come of age they continue to move deeper and deeper into the Chang Tang in search of available grazing lands for their herds, entering habitat previously occupied only by wildlife, which has lead to increasingly frequent incidences of human-wildlife conflict. The frequen-

cy of this conflict has grown to the point where human-wildlife conflict, not commercial poaching, is now considered to be the largest threat to the survival of several species in the Chang Tang region, in particular the snow leopard and the endemic Tibetan brown bear and wild yak.

This conflict between humans and wildlife has inflicted, at times, great economic losses on poor herding families, many of whom have incomes on the order of only US \$400 per year. In the Chang Tang and Seling Lake Nature Reserves, human-wildlife conflicts are of four primary types:

- 1) Tibetan brown bear, snow leopard, wolves, lynx, and fox killing sheep, goats and other domestic animals both in corrals and on open pasture lands;
- 2) Brown bears ransacking herders' cabins and tents in search of food, badly damaging or destroying homes and furnishings in the process;
- 3) Loss of important grass resources to large herds of widely migrating Tibetan wild ass, Tibetan antelope and Tibetan gazelle, particularly in pastures reserved by herders for winter grazing of domestic livestock, possibly leading to winter starvation of livestock;
- 4) Driving off of domestic female yaks by wild yak bulls in search of harems.

In addition, many herders have been chased and attacked by Tibetan brown bears and wild yaks, and most nomads feel that bears and wild yaks pose the greatest threat to their safety while out on the steppe. Economic losses in the form of destroyed homes, livestock killed or driven away, foodstuffs lost, and on occasion severe physical injury or even death of family members from wildlife conflict can be economically devastating for poor herding households, so it is not surprising that in spite of the ban on hunting and weapons in the Chang Tang, the retaliatory killing of wildlife quietly continues. Thus understanding and resolving the issue of human-wildlife conflict is the key to building a harmonious coexistence between nomads and wildlife in the Chang Tang and Seling Lake Nature Reserves, which is crucial if these reserves are to fulfill their purpose of preserving the Chang Tang region's unique assemblage of large fauna in perpetuity.

The report which follows will focus on the impact of the Chang Tang's five large predator species, particularly the Tibetan brown bear, on local herders, as collectively conflict with these species is believed to exact the highest economic toll on the region's herders in the form of easily quantifiable livestock kills and property damage. While grazing competition between domestic livestock and large herds of wild ungulates is also known to be a large source of econom-

ic losses for herders, losses resulting from this type of competition are less tangible and consequently more difficult to quantify. Thus the authors limited their investigation of grazing conflict to the lump sum of all incidences of grazing competition conflict with the Chang Tang's most numerous ungulate species: Tibetan wild ass, Tibetan antelope, Tibetan gazelle, blue sheep, and wild yak. No attempt was made to quantify incidence of grazing competition by individual species, although the Tibetan wild ass is considered by local herders to be the biggest source of grazing competition conflict. It should be noted that although the loss of domestic female yaks to wild yak bulls in search of harems can be financially devastating for affected households, this type of non-grazing conflict with wild yaks was not specifically addressed in this survey since the largest populations of wild yaks in the region are found north of the area covered in the present survey. Nevertheless, this is an important issue that needs further research and should be the subject of a separate survey.

1.3 The Human-Wildlife Conflict Survey Methodology

In order to gain an understanding of how human-wildlife conflict is affecting herders and wildlife in the region of the Chang Tang and Seling Lake Nature Reserves, in April of 2006 the authors conducted a survey of 300 herding

households in the southern Chang Tang's zone of high population concentration in Nagchu Prefecture's Shenzha, Tsonyi, and Nyima Counties (Map 2). Of the nine counties that fall within the Chang Tang and Seling Lake Nature Reserves, the above three counties were chosen for this survey for two primary reasons: 1) The authors have conservation projects ongoing in these three counties and the information obtained will be used in the later stages of these projects, and 2) road conditions in these three counties, though poor, are still much better than in the more remote areas of the reserves, which made it much easier to conduct the survey in a reasonable amount of time.

The survey did not intend to specifically target areas already known to have high incidence of human wildlife conflict, but sought to gain a broader view of this issue in the most heavily populated areas of the TAR's south-central Chang Tang. In order to get a fairly random geographic sampling from these three counties, the names of all townships in each county were placed in a box, and two townships from each county were drawn in a lottery. The original intention had been to interview 50 residents in each township, however, when this proved to be logistically unfeasible, a simple total of 100 residents were interviewed from two townships in both Shenzha and Nyima counties, while a total of 100 residents were interviewed in three randomly se-

lected townships in Tsonyi County (Table 1.1). The only criteria used when choosing individual households to interview was that all households had to be engaged in livestock herding as their primary occupation, and their homes and camps had to be accessible by jeep. Consequently, no herders dwelling in remote camps accessible only by horseback or foot were interviewed.

Table 1.1. Number of surveyed households by county and township.

County	Township	Number of Surveyed Households	Percent of Total Surveyed
Nyima	U'chu	45	15
	Nyima	55	18.3
Shenzha	Shenzha	78	26
	Maibe	22	7.3
Tsonyi	Parling	51	17
	Shide	19	6.3
	Tso Lho	30	10
Total		300	100

The actual survey consisted of a four page questionnaire (Appendix 2) with sections on;

- The surveyed household's economic status and mode of living;
- The nature of wildlife conflict experienced, if any;

- Herders' opinions on the causes of and solutions to wildlife conflict;
- Herder's knowledge of wildlife conservation issues;
- The distributions of the endangered Tibetan brown bear and snow leopard in the areas visited.

It should be noted that nomadic herders formerly accustomed to supplementing their incomes and preventing wildlife conflict by hunting and trapping wildlife often grossly inflate the threat that both wild predators and ungulates pose to their livelihoods, particularly when talking to wildlife researchers. However, herders who spend long hours out on the land in remote areas each day are also one of the best sources of information about wildlife populations in these areas. Thus while a herder's response to a given survey question may be exaggerated in hopes that the survey results will contribute to reversing policies banning hunting of wildlife, it is nevertheless felt that the general pattern of human-wildlife conflict that emerged from this survey is accurate, and that resolving this conflict is of utmost importance if the extinction of northern Tibet's steppe dwelling large fauna is to be prevented.

Part II. Socio-Economic Status of Surveyed Herding Households

2.1 Household Type

In order to learn about the mode of living of surveyed herders and to see if there is any correlation between the dwelling type chosen and the frequency of incidence of human-wildlife conflict, herders were asked about the type of residence they occupied. The survey revealed three basic household types in the survey area, families that live year-round in permanent houses, families that live year-round in tents, and families with a mixed lifestyle that reside for parts of each year in both houses and tents (Table 2.1, Figure 2.1).

Table 2.1. Household type of surveyed households by county.

Household Type	County			Totals	
	Nyima	Shenzha	Tsonyi	Total Number by Household Type	Percent of Total Surveyed
House	58	36	45	139	46
Tent	7	2	8	17	6
Mixed	35	62	47	144	48
Total by County	100	100	100	300	100

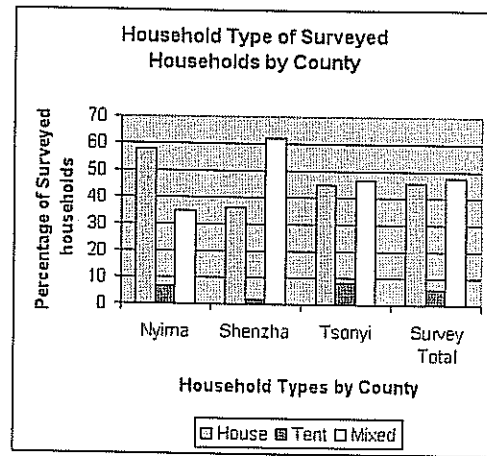
Note: Because 100 households were surveyed in each county, county figures also represent percentages for individual counties.

In total, 46 percent of surveyed herding households lived year round in permanent houses. In the Chang Tang region, permanent homes are a relatively new phenomena, only having been widely adopted by herders since the 1970s when the introduction of roads and vehicles in the Chang Tang made simple building materials widely available in the markets of local townships. These homes are typically single-room brick huts with roofs made from wooden beams sealed with plastic tarps that are held down by a layer of dry mud (Photo 1). Better off families were seen to have up to four-room brick houses. While some families live year round in the same house, others have constructed two such houses at both their summer and winter camps.

The most common mode of residence, though, was that of the mixed residence of 48 percent of surveyed households. These families typically constructed permanent brick cabins at their winter camp and lived in tents at their summer camps, although some larger families also erected tents next to their brick cabins to house family members. Of only minor importance were families that lived year round in tents, which comprised 6 percent of survey respondents. These were typically poorer families, the poorest of which resided in home-made tents sewn from cotton canvas purchased in the market, while better off tent dwellers resided in the traditional black yak-hair tents commonly found

throughout much of the Tibetan cultural area (Photo 2).

Figure 2.1. Household type of surveyed households by county.



2.2 Living Arrangement

In order to learn about the social organization of surveyed herders and to see if there is any correlation between the size of herding groups and the frequency of incidence of human-wildlife conflict, herders were asked about their living arrangements, which were categorized simply as either individual families living alone or multiple families residing together as groups (Table 2.2, Figure 2.2).

Table 2.2. Living arrangement of surveyed households by county.

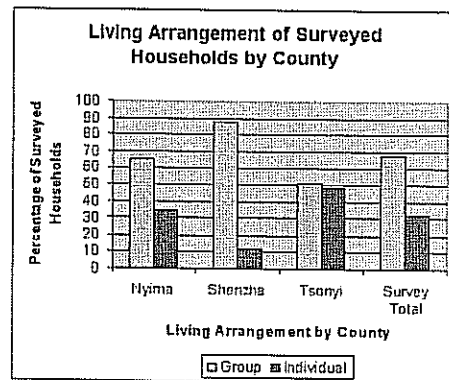
Living Arrangement	County			Totals	
	Nyima	Shenzha	Tsonyi	Total Number by Living Arrangement	Percent of Total Surveyed
Group	65	88	51	204	68
Individual	35	12	49	96	32
Total by County	100	100	100	300	100

Note: Because 100 households were surveyed in each county, county figures also represent percentages for individual counties.

Apart from a few areas of the southern Chang Tang with relatively milder climates and more productive pastures where herders reside year round in the same place, the vast majority of the Chang Tang's herders move seasonally between summer and winter pastures. A large percentage of surveyed herders, 32 percent, do so as individual families, often living at great distances from the nearest neighbors or township. But most herders surveyed, 68 percent, were found to have formed group living arrangements. Herding groups in rural areas typically consisted of two families living side by side, less often three families living together, which facilitates division of labor and provides some degree of safety in the event of an emergency. However, in winter many herders surveyed returned to dwell in township seats, typically small villages consisting of 30 households, which provided easy access to social services, such as schools and medical clinics, as well as providing easy access to dealers

and markets for livestock products. Thus only surveyed families living by themselves year-round without returning to the township in winter have been counted as "individual" families in this survey.

Figure 2.2. Living arrangement of surveyed households by county.



2.3 Self-Assessed Economic Status

In order to learn about how surveyed herders perceive their own economic status, and to see if there is any correlation between the frequency of incidence of human-wildlife conflict and economic status, which in herding economies is largely a function of herd size, herders were asked to categorize themselves simply as being poor, middle class, or rich (Table 2.3, Figure 2.3).

Table 2.3. Self-assessed economic status of surveyed households by county.

Self-Assessed Economic Status	County			Totals	
	Nyima	Shenzha	Tsonyi	Total Number by Economic Status	Percent of Total Surveyed
Poor	26	33	17	76	25
Middle-Class	67	53	69	189	63
Rich	7	14	14	35	12
Total by County	100	100	100	300	100

Note: Because 100 households were surveyed in each county, county figures also represent percentages for individual counties.

In this survey, the vast majority of respondents, 63 percent, considered themselves to be middle class, while 25 percent of respondents considered themselves to be poor and 12 percent of respondents categorized themselves as rich. Tabulation of livestock holdings among the surveyed herding households revealed combined sheep and goat holdings to be the livestock types of greatest economic importance. While yaks only appear to be of secondary economic importance in the survey area, they are culturally important as the source of wool for tents, ropes, and clothes; for meat; and for butter for making tea and burning in lamps. Somewhat surprisingly given the large numbers of livestock to be herded and the remoteness of the terrain, surveyed households owned

very few horses, with only seven households owning more than ten horses, while 91 households, or 30 percent of those surveyed, owned none at all, either herding their livestock on foot or having replaced horses for work and transportation with motorcycles and jeeps (Table 2.4, Figures 2.4 and 2.5). None of the households surveyed owned cows, as these are difficult to raise in the cold arid Chang Tang climate with its extremely thin cover of short grasses that are not suitable for haying for supplemental winter fodder.

Figure 2.3. Self-assessed economic status of surveyed households by county.

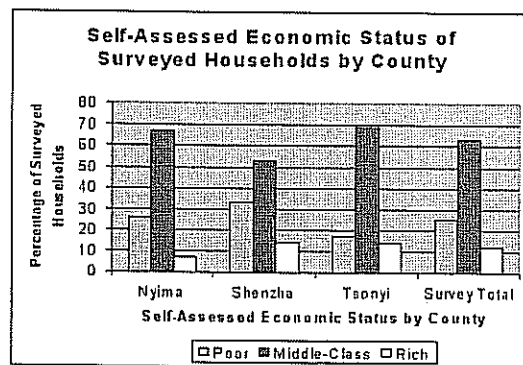


Table 2.4. Total livestock holdings of surveyed households by county.

Livestock Type	County			Livestock Totals by Type
	Nyima	Shenzha	Tsonyi	
Sheep	21,217	17,547	22,364	61,128
Goat	11,759	6,541	9,354	27,654
Yak	1,771	3,928	1,091	6,790
Horse	231	144	340	715
Total Head by County	34,978	28,160	33,149	96,287

Figure 2.4. Total livestock holdings of surveyed households by county.

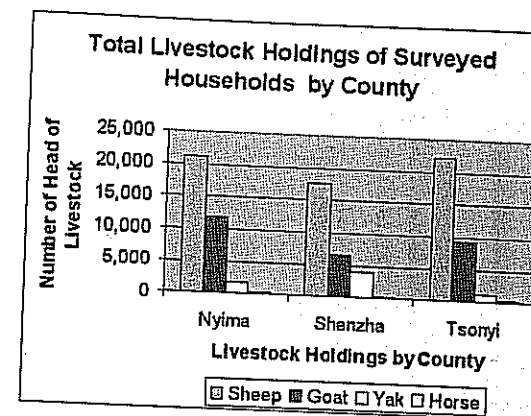
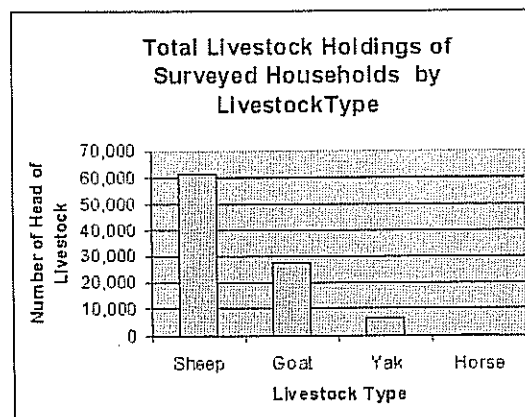


Figure 2.5. Total livestock holdings of surveyed households by livestock type.

While there is a minimum number of head of livestock per household member that is needed to sustain a "middle-class" herding lifestyle and provide insurance against large losses in the event of natural disasters, such as exceptionally severe winters, this figure is highly variable. Such factors affecting this figure include productivity of a herding family's pasture lands, severity of climate, type of livestock owned and quantity of each type, distance to markets, and alternative sources of income to herding. Thus, the actual number of livestock held by a household in any of the three economic categories was highly variable, as Table 2.5 below shows.

Table 2.5. Ranges of livestock holdings of surveyed households by self-assessed economic status.

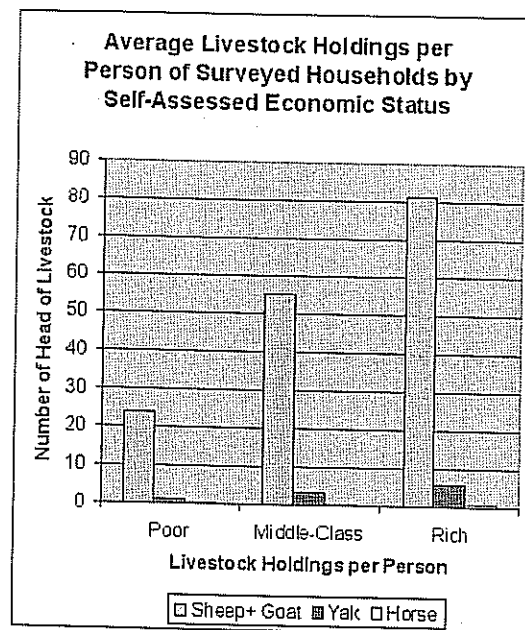
Self-Assessed Household Economic Status	Livestock Type		
	Sheep and Goats Combined	Yak	Horse
Poor	0-1200	0-120	0-6
Middle-Class	32-900	0-102	0-20
Rich	90-1550	0-138	0-15

However, the number of family members in the households surveyed ranged from 1 to 21 people, and when household livestock holdings were calculated on a per person basis a distinct class stratification based on livestock holdings emerged (Table 2.6, Figure 2.6).

Table 2.6. Average livestock holdings per household member of surveyed households by self-assessed economic status.

Self-Assessed Household Economic Status	Livestock Type				
	Sheep	Goat	Sheep and Goats Combined	Yak	Horse
Poor	15	9	24	1	0
Middle-Class	37	18	55	3	0
Rich	58	23	81	6	1

Figure 2.6. Average livestock holdings per person of surveyed households by self-assessed economic status.



Part III. Analysis of Wildlife Conflict by Household Socio-Economic Status

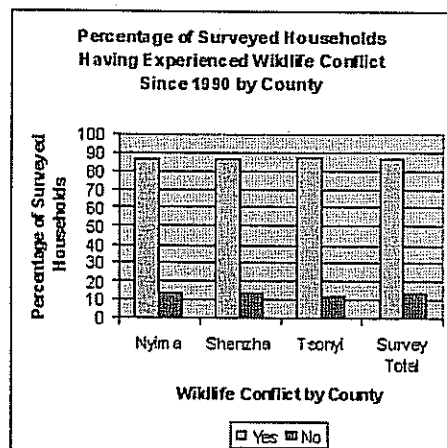
3.1 Overall Human-Wildlife Conflict

In total, 87 percent of all surveyed households reported experiencing conflict with wild predators and/or ungulates at least once since 1990, clearly illustrating just how pervasive the problem of human-wildlife conflict is in the southern Chang Tang region (Table 3.1, Figure 3.1).

Table 3.1. Number of surveyed households having experienced wildlife conflict since 1990 by county.

County	Nyima	Shenzha	Tsonyi	Number of Households	Percent of Total Surveyed
Number of Surveyed Households Experiencing Wildlife Conflict Since 1990	86	86	88	260	87
Number of Surveyed Households NOT Experiencing Wildlife Conflict Since 1990	14	14	12	40	13

Note: Because 100 households were surveyed in each county, county figures also represent percentages for individual counties.

Figure 3.1. Percentage of surveyed households having experienced wildlife conflict since 1990 by county.

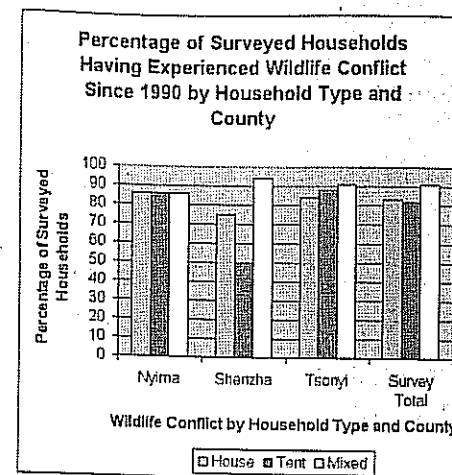
3.2 Wildlife Conflict by Household Type and County

Overall wildlife conflict was broken down by household type to see if dwelling type had any bearing on frequency of wildlife conflict (Table 3.2, Figure 3.2).

Table 3.2. Percentage of surveyed households having experienced wildlife conflict since 1990 by household type and county.

Household Type	Nyima	Shenzha	Tsongyi	Percent of Total Surveyed
House	86	75	84	83
Tent	86	50	88	82
Mixed	86	94	91	91

Note: See Table 2.1, "Household type of surveyed households by county," for total numbers of each household type.

Figure 3.2. Percentage of surveyed households having experienced wildlife conflict since 1990 by household type and county.

While tents only comprised six percent of all households surveyed, and only two tent households were interviewed in Shenzha County, the above figures clearly show that all three household types were more or less equally prone to experiencing extremely high incidence of wildlife conflict. Thus dwelling in a house as opposed to a tent afforded herders little protection from wildlife conflict. Many mixed households reported that their permanent winter houses were raided by bears while the family was away at summer camp residing in a tent, which may explain the slightly higher incidence of conflict reported by this group. Al-

though tent dwellers occupied their tents year round and some house dwellers had their winter homes in the township seats that are populated all year, house and tent dwellers were only slightly less prone to brown bear attack than "mixed" type households.

3.3 Wildlife Conflict by Living Arrangement and County

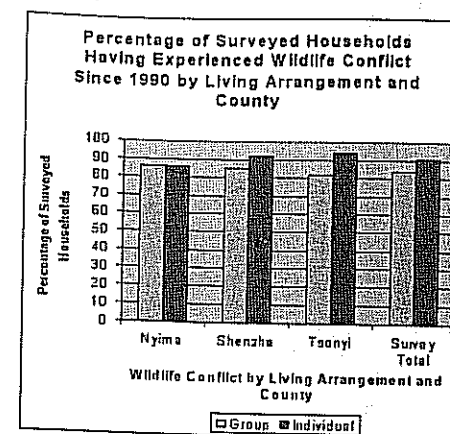
Overall wildlife conflict was broken down by living arrangement to see if lone herding families were more prone to being victims of wildlife conflict than families living in groups (Table 3.3, Figure 3.3).

Table 3.3. Percentage of surveyed households having experienced wildlife conflict since 1990 by living arrangement and county.

Living Arrangement	County			Percent of Total Surveyed
	Nyima	Shenzha	Tsonyi	
Group	86	85	82	84
Individual	86	92	94	91

Note: See Table 2.2, "Living arrangement of surveyed households by county," for total numbers of individual and group households.

Figure 3.3. Percentage of surveyed households having experienced wildlife conflict since 1990 by living arrangement and county.



While incidence of overall wildlife conflict was slightly higher among individuals than groups, with 91 percent of all individual households surveyed having experienced wildlife conflict as opposed to 84 percent for herders living in groups, living in groups of more than one household clearly offers herders little protection from economic losses resulting from wildlife conflict.

3.4 Wildlife Conflict by Self-Assessed Economic Status and County

Overall wildlife conflict was broken down by self-assessed economic status to see if herd size had any bearing on

the frequency of incidence of human-wildlife conflict (Table 3.4, Figure 3.4).

In two out of three surveyed counties, poor families with presumably smaller herd sizes appeared to be less prone to human-wildlife conflict than rich and middle-class families. However, with 78 percent, 90 percent, and 86 percent of all poor, middle class, and rich households reporting having experienced wildlife conflict since 1990, respectively, all households surveyed, regardless of herd size and economic status, appear to be highly prone to experiencing human-wildlife conflict.

Table 3.4. Percentage of surveyed households having experienced wildlife conflict since 1990 by self-assessed economic status and county.

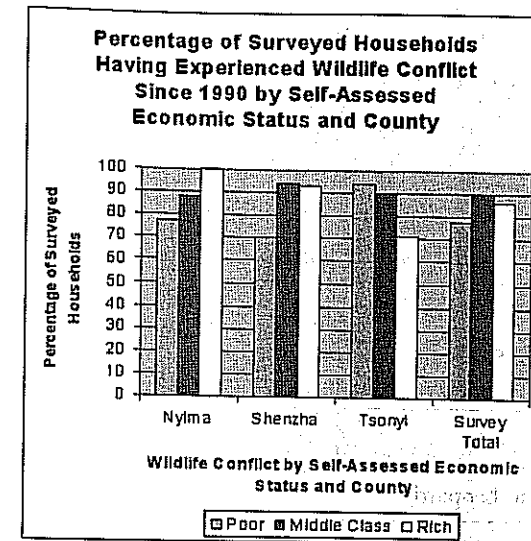
Self-Assessed Economic Status	County			Percent of Total Surveyed
	Nyima	Shenzha	Tsonyi	
Poor	77	70	94	78
Middle Class	88	94	90	90
Rich	100	93	71	86

Note: See Table 2.3, "Self-assessed economic status of surveyed households by county" for total numbers of households of each economic status.

In summary, households type, living arrangement, and economic status were not important factors in determining a

household's propensity for being the victim of wildlife conflict. 87 percent of all households surveyed reported being victims of some form of human-wildlife conflict since 1990, which cut nearly uniformly across all three of the above socio-economic factors examined in this survey.

Figure 3.4. Percentage of surveyed households having experienced wildlife conflict since 1990 by self-assessed economic status and county.



Part IV. Analysis of Wildlife Conflict by Species and Household Socio-Economic Status

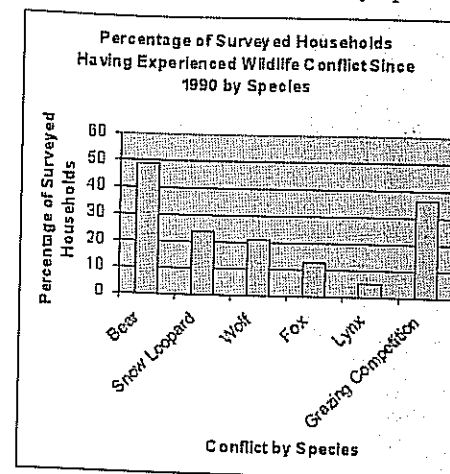
4.1 Overall Wildlife Conflict by Species

As discussed in sub-section 1.2, above, both conflict with the Chang Tang's five largest predators and grazing competition with all wild ungulate species in the Chang Tang as a whole were analyzed (Table 4.1, Figure 4.1).

Table 4.1. Percentage of surveyed households having experienced wildlife conflict since 1990 by species.

Species	Percentage of Households Experiencing Conflict by Species
Bear	49
Snow Leopard	24
Wolf	21
Fox	13
Lynx	5
Grazing Competition	36

Figure 4.1. Percentage of surveyed households having experienced wildlife conflict since 1990 by species.



From Figure 4.1, it can be seen that the endangered Tibetan brown bear is the largest source of human-wildlife conflict amongst surveyed herders, with 49 percent of all surveyed households reporting conflict with brown bears since 1990, while 36 percent reported conflict with brown bears since 1990, while 36 percent reported grazing competition conflict, 24 percent reported conflict with the endangered snow leopard, and 21 percent reported conflict with the ubiquitous wolf. At 13 percent and 5 percent of all surveyed households, conflict with fox and lynx, respectively, were relatively minor problems.

4.2 Wildlife Conflict by Species and County

When human-wildlife conflict was analyzed by county,

an interesting pattern of geographic distribution of wildlife conflict caused by individual species emerged for the survey area (Table 4.2, Figure 4.2)

Table 4.2. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and county.

Species	County			Percent of Total Surveyed
	Nyima	Shenzha	Tsonyi	
Bear	34	60	52	49
Snow Leopard	15	50	6	24
Wolf	20	20	22	21
Fox	9	7	24	13
Lynx	15	0	1	5
Grazing Competition	63	11	35	36

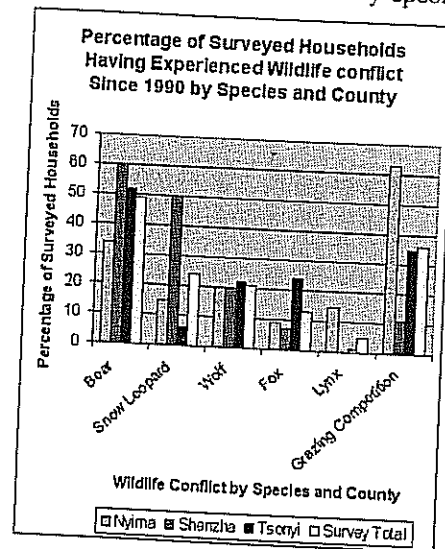
From Figure 4.2 it can be clearly seen that the Tibetan brown bear was a particularly large problem for herding households in Shenzha and Tsonyi Counties, affecting 60 percent and 52 percent of surveyed households in these counties since 1990, respectively, while only being somewhat less of a problem in Nyima County, where 34 percent of households surveyed reported conflict with brown bears. Mountainous Shenzha County had far and away the largest snow-leopard problem, with 50 percent of all surveyed households reporting having experienced conflict with snow leopards since 1990, more than three times the reported in-

cidence of snow leopard conflict amongst surveyed households in Nyima County and more than eight times that of Tsonyi County. Incidence of wolf conflict was fairly uniform across the survey area at 20 percent, 20 percent, and 22 percent of surveyed households in Nyima, Shenzha, and Tsonyi Counties, respectively. While overall conflict with fox and lynx was relatively minor in extent, fox conflict was a fairly large problem in Tsonyi County, where 24 percent of households reported experiencing fox conflict since 1990. Of 16 households reporting conflict with lynx since 1990, 15 were located in Nyima County.

Nyima County also had by far the largest problem with wild ungulates, with 63 percent of households reporting grazing competition conflict since 1990, as compared with just 35 percent of surveyed households in Tsonyi County and 11 percent of surveyed households in Shenzha County. For more detailed analysis of causes of the above types of conflict, see Parts V and VI concerning wildlife conflict with individual species, below.

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Figure 4.2. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and county.



4.3 Wildlife Conflict by Species and Household Type

Analysis of wildlife conflict by individual species with respect to household type revealed no clear pattern indicating that any given species was more prone to coming into conflict with one type of dwelling than with the others (Table 4.3, Figure 4.3).

Bears were unique among the Chang Tang's five large predators in that in addition to killing livestock they make direct raids on houses and tents in search of human food, affecting 34 percent and 47 percent of surveyed house and tent dwellers, respectively, while "mixed" type households

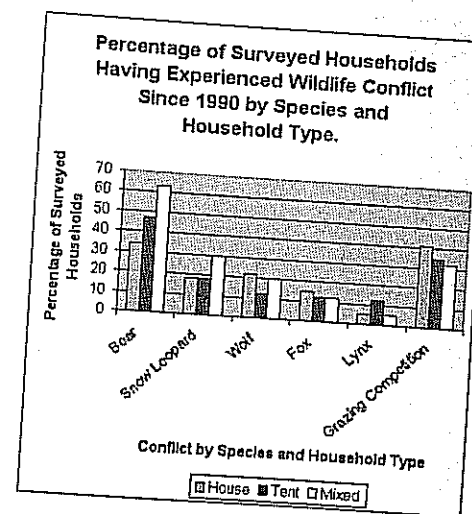
Human-Wildlife Conflict in the Chang Tang Region of Tibet

were the hardest hit by bears with 63 percent of these households experiencing bear conflict.

Table 4.3. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and household type.

Species	Household Type		
	House	Tent	Mixed
Bear	34	47	63
Snow Leopard	18	18	30
Wolf	22	12	20
Fox	15	12	12
Lynx	5	12	5
Grazing Competition	41	35	32

Figure 4.3. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and household type.



The remaining four predator species are not known to enter human dwellings in search of food, but rather attack livestock kept on open pastures or near human dwellings, at times even when a herder is present guarding the livestock. Although from the small number of lynx conflicts reported, 16 in total, lynx appear to strike at tent camps with greater frequency than houses, no clear pattern emerges for snow leopards, wolf or fox. Grazing competition may or may not occur while herders are present, however household type did not appear to be a factor, and many herders reported that wild ungulate herds grazed their winter pastures while the family was away at summer camp.

Thus household type does not appear to be a major factor in determining a herding camp's likelihood of experiencing human-wildlife conflict, except possibly for conflict with bears.

4.4 Wildlife Conflict by Species and Living Arrangement

As with analysis of wildlife conflict by species and household type, analysis of conflict by species and living arrangement revealed no consistent pattern indicating that either group or individual herding households in the Chang Tang are more prone to experiencing wildlife conflict with any given species (Table 4.4, Figure 4.4).

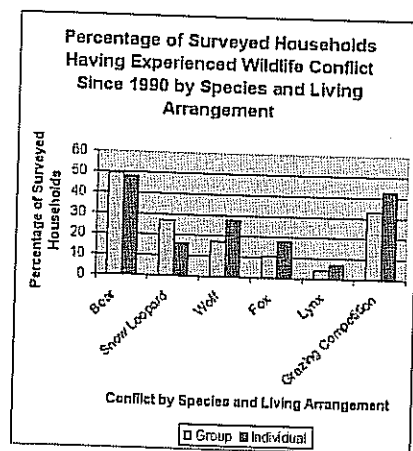
Table 4.4. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and living arrangement.

Species	Living Arrangement	
	Group	Individual
Bear	49	48
Snow Leopard	27	16
Wolf	17	28
Fox	11	18
Lynx	4	7
Grazing Competition	33	43

Households living in groups tend to occupy areas of higher grassland productivity, which provide better habitat for livestock as well as for wild ungulates and predators, and these groups may leave up to five winter houses behind when families move to summer camp (Photo 3). However, in spite of this, there is no appreciable difference between the frequency with which group and individual household camps experience human-bear conflict, with 49 percent of group households and 48 percent of individual households in this survey reporting having experienced bear conflict since 1990. While groups appear to be more prone to experiencing snow leopard conflict, with 27 percent of surveyed groups reporting having experienced snow leopard conflict since 1990 versus 16 percent for individuals, this may simply be a reflection of the fact that in Shenzha County, where 70 percent of all households experiencing snow leopard conflict are located, 88 percent of surveyed households reside in groups.

Individual herding households reported experiencing conflict with wolves, fox, and lynx at 39 percent, 39 percent, and 43 percent higher rates, respectively, than groups. This may be the result of there being less nighttime activity from humans and dogs at individual camps than at group camps. Individual herding households also reported a 23 percent higher incidence of grazing competition conflict than groups, which may be a result of individual households living in more marginal northern grassland areas that wild ungulates have been displaced to by the large numbers of domestic livestock which occupy the Chang Tang's more productive southern grasslands.

Figure 4.4. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and living arrangement.



4.5 Wildlife Conflict by Species and Self-Assessed Economic Status

As with household type, and living arrangement, no clear pattern emerged reflecting the tendency of a household of a given self-assessed economic status to experience wildlife conflict (Table 4.5, Figure 4.5).

While the percentage of "rich" households surveyed was only 12 percent of the total, this economic bracket had the highest rate of incidence of conflict with bears and snow leopards at 60 percent and 31 percent, respectively, followed by "middle-class" households at 49 percent and 25 percent for bears and snow leopards, respectively, with 43 and 17 percent of "poor" households reporting conflict with bears and snow leopards. The higher rate of incidence of bear and snow leopard conflict among "rich" households may be due in part to wealthier households having larger numbers of less adequately guarded livestock, while in the case of bears, another contributing factor is that "rich" households are more likely to own seasonal homes that are unoccupied and unguarded much of the year.

However, in the cases of wolves, fox, and grazing competition, middle-class households have the highest rates of incidence of conflict, while poor and rich households are affected in nearly equal, but slightly lower percentages, which may be simply a reflection of the fact that 63 percent

of all households surveyed considered themselves to be "middle-class."

In the case of the small number of households reporting lynx conflict, 8 percent of "poor" households reported experiencing lynx conflict as opposed to 6 percent of "rich" households and only 4 percent of "middle-class" households.

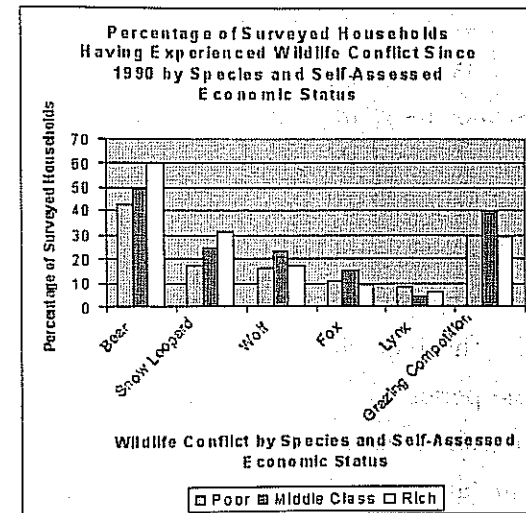
Wildlife conflict caused by species included in this survey cut across all three socio-economic factors surveyed: household type, living arrangement, and economic status.

While in this survey the Tibetan brown bear and snow leopard had slightly higher tendencies to come into conflict with both "rich" households and those with "mixed" residence types, in general households in all socio-economic categories experienced wildlife conflict with a fairly equal degree of frequency, and socio-economic factors were far less important in determining the frequency of conflict with a given species than geographic location.

Table 4.5. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and self-assessed economic status.

Species	Self-Assessed Economic Status		
	Poor	Middle Class	Rich
Bear	43	49	60
Snow Leopard	17	25	31
Wolf	16	23	17
Fox	11	15	9
Lynx	8	4	6
Grazing Competition	30	40	29

Figure 4.5. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and self-assessed economic status.



4.6 Wildlife Conflict by Species and Time Period

For the sake of analysis, wildlife conflict over the period under investigation was divided into three roughly equal time periods, the 6-year period from January 1990 to December 1995, the 5-year period from January 1996 to December 2000, and the 5-year and 4-month period from January 2001 to April 2006. Because a number of survey respondents were not old enough to have been heads of households during the first two time periods, it was necessary to estimate the number of extant households in each of the first two survey time periods. In order to arrive at this estimate, it was simply assumed that respondents, as heads of households, had to have been at least 18 years of age in the last year of the first two time periods, 1995 and 2000, for their household to have existed in that time period. Thus by eliminating respondents younger than 18 years of age in each of the first two time periods, we arrive at an estimated 258 of the surveyed households being extant in the first survey time period, 1990-1995, and an estimated 287 of the surveyed households being extant in the second survey time period, 1996-2000. The breakdown of estimated extant households in each time period by county is given below (Table 4.6).

When broken down into these three five to six year time periods from January of 1990 to April of 2006, analysis of wildlife conflict among surveyed households by time period

and species showed a clear and dramatic roughly two to over five-fold increase in conflict over the three survey time periods (Table 4.7, Figure 4.6).

Table 4.6. Estimated number of extant surveyed households in each of the three survey time periods by county.

Time Period	County			Total by Time Period
	Nyima	Shenzha	Tsonyi	
1990-1995	90	86	82	258
1996-2000	95	96	96	287
2001-2006	100	100	100	300

Table 4.7. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and time period.

Species	Time Period		
	1990-1995	1996-2000	2001-2006
Bear	9	11	39
Snow Leopard	3	4	17
Wolf	6	7	17
Fox	5	5	12
Lynx	1	1	5
Grazing Competition	7	8	34

Note: See Table 4.6 for the estimated number of extant surveyed households in each of the three survey time periods by county.

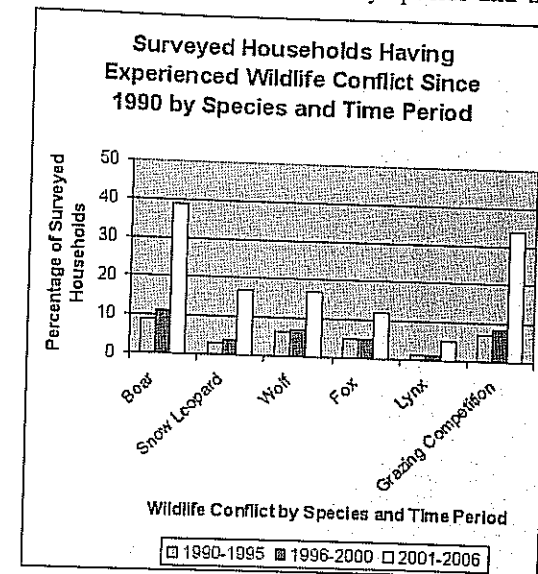
While memories fade, and exact years are forgotten, it was nevertheless felt that a time period analysis of wildlife

conflict in the Chang Tang Nature Reserve would be of great interest in chronicling the impact of the establishment of the Chang Tang and Seling Lake reserves on human-wildlife conflict in the survey area. So while exact years of occurrence of wildlife conflict can not always be determined amongst nomadic herders who are often even unsure of the years and dates of birth of their children, the estimated dates of wildlife conflict given nevertheless show that the incidence of human-wildlife conflict has risen dramatically since 2001.

This dramatic rise in human-wildlife conflict since 2001 can be attributed to several factors. Although the Chang Tang reserve was created in 1993 as a provincial level nature reserve, in 1999 a new management plan and management structure for the reserve were established, with more vigilant anti-poaching patrols being set-up. This was followed by a campaign to collect all weapons and traps from the inhabitants of the reserve beginning in 2001. Also in 2001, the Chang Tang reserve was elevated from a provincial-level to a national-level nature reserve, giving further impetus to putting an end to all forms of hunting in the reserve (Fox and Tsering 2005). Together, these actions have resulted in the dramatic decreases in commercial poaching and subsistence hunting seen today. Consequently, with most occupants of the region now having been dis-

armed, the behavior of wild animals in the Chang Tang has become increasingly aggressive with respect to humans and their livestock and pastures. Wild animals are no longer as conditioned to fear humans due to the decline in killing of wildlife by herders and poachers brought on by the threat of fine or imprisonment, which has in turn led to a surge in the incidence of human-wildlife conflict throughout the survey region.

Figure 4.6. Percentage of surveyed households having experienced wildlife conflict since 1990 by species and time period.



It should be noted that surveyed herders were most in-

terested in discussing the recently arisen phenomena of widespread bear conflict, and to a lesser extent conflict with snow leopards. Conflict with wolves, lynx, and fox was considered a normal, expected, part of their lives and may have been under-reported since these type of conflicts were clearly less of a concern to herders than conflict with bears and snow leopards, which they are now strictly prohibited from taking up arms against.

Part V. Analysis of Human-Bear Conflict

With 49 percent of surveyed households having experienced conflict with Tibetan brown bears since 1990, brown bears are by far the single species inflicting the greatest economic losses on herders residing in and around the Chang Tang and Seling Lake Nature Reserves (Photo 4). Losses inflicted by brown bears are diverse in form and include livestock kills; direct damage to corrals, homes, and home furnishings; loss of human food supplies; and occasionally direct physical injury or even death of household members (Photos 5 and 6). Given this situation, in the species accounts which follow, human-bear conflict is examined in greater scope than conflict with other species.

5.1 Human-Bear Conflict by County and Surveyed Socio-Economic Factors

The following data concerning bear conflict as a function of county, household type, living arrangement, and self-assessed economic status is excerpted from report subsections 4.2, 4.3, 4.4, and 4.5, above.

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Table 5.1. Percentage of surveyed households having experienced bear conflict since 1990 by county.

Species	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Bear	34	60	52	49

Table 5.2. Percentage of surveyed households having experienced bear conflict since 1990 by household type.

Species	Household Type		
	House	Tent	Mixed
Bear	34	47	63

Table 5.3. Percentage of surveyed households having experienced bear conflict since 1990 by living arrangement.

Species	Living Arrangement	
	Group	Individual
Bear	49	48

Table 5.4. Percentage of surveyed households having experienced bear conflict since 1990 by self-assessed economic status.

Species	Self-Assessed Economic Status		
	Poor	Middle Class	Rich
Bear	43	49	60

Human-Wildlife Conflict in the Chang Tang Region of Tibet

As discussed in Part IV, above, human-bear conflict was widespread, cutting across all surveyed socio-economic factors, and seemed to be primarily a function of geographic location and, to a lesser extent, household type. In terms of geography, Shenzha County had the highest incidence of bear conflict in the survey area, with 60 percent of households in that county reporting having experienced bear conflict since 1990 (Table 5.1). When analyzed on the basis of residence type, 47 percent of tent dwelling households reported experiencing conflict since 1990, though tent dwellers only comprised 6 percent of all households surveyed, a much higher rate than for house dwellers, 34 percent of which reported experiencing conflict with bears (Table 5.2). This may be a result of the statistically small number of tents surveyed, however the author's can offer no satisfactory explanation for this discrepancy since tents are generally occupied year round and are presumed to be better guarded than seasonally vacant houses. One possible explanation for the lower rate at which house dwellers were affected by bear conflict is that some house-dwelling families reside in township centers in winter, which have a year-round human presence that may reduce the likelihood of bears raiding these winter homes while the family is away in summer. However, "mixed" household types dividing the year between tents and houses, which made up 48 percent of all

households surveyed, also had the largest reported incidence of bear conflict at 63 percent (Table 5.2). This may be explained in part by the fact that many of these households reported that their winter cabins were raided by bears in search of food while families were away at summer camp.

48 percent of individual households surveyed reported experiencing bear conflict since 1990 versus 49 percent of group living arrangements (Table 5.3). Thus living in groups of up to five families, though more typically just two to three families, appears to offer no deterrent to keep bears from raiding herding camps. In terms of economic status, 43 percent of surveyed "poor" families reported having experienced bear conflict since 1990, as opposed to 49 percent of middle-class families and 60 percent of rich families (Table 5.4). The higher rate of incidence of bear conflict among "rich" households may be due in part to the fact that wealthier households have larger numbers of livestock per family member, which makes it more difficult to adequately protect large dispersed herds from predation by bears and other predators. Another factor contributing to higher rates of bear conflict amongst "rich" households may be that wealthier families generally owned more than one home, one of which is left unoccupied seasonally and thus is more prone to attack by bears in search of food. In fact some poor households have so few animals that they leave them in the

care of friends or relatives with larger herds, and many poor families supplement their minimal herding incomes by having a family member take a job in the local township doing cleaning, cooking, or working in a shop, possibly explaining in part the somewhat lower rate of bear conflict among poor families.

Regardless of location and socio-economic status, however, human-bear conflict is a large problem in the region of the Chang Tang and Seling Lake Nature Reserves, and resolving this issue is a matter of great importance if the Tibetan brown bear is to continue to exist in its traditional manner, in which its survival is largely based on its ability to hunt pikas rather than on its ability to raid herding camps in search of livestock and human foodstuffs.

5.2 Human-Bear Conflict by Time Period and County

When analyzed on a county by county basis, dramatic increases in the frequency of human-bear conflict over the three survey time periods become readily apparent in all three counties (Table 5.5, Figure 5.1).

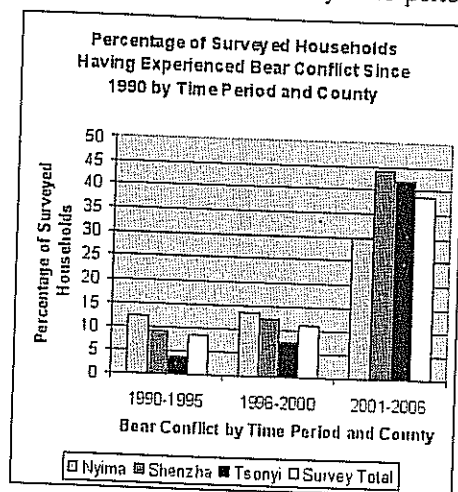
Human-Wildlife Conflict in the Chang Tang Region of Tibet

Table 5.5. Percentage of surveyed households having experienced bear conflict since 1990 by time period and county.

Species: Bear	County			
Time Period	Nyima	Shenzha	Tsonyi	Survey Total
1990-1995	12.2	9.3	3.7	8.5
1996-2000	13.7	12.5	7.3	11.1
2001-2006	30	44	42	38.7

Note: See Table 4.6 for the estimated number of extant surveyed households in each of the three survey time periods by county.

Figure 5.1. Percentage of surveyed households having experienced bear conflict since 1990 by time period and county.



As the above figure shows, since creation of the Chang Tang and Seling Lake Nature Reserves, the number of

Human-Wildlife Conflict in the Chang Tang Region of Tibet

households experiencing human-bear conflict has increased roughly 4 and half times, most dramatically in Tsonyi County, where there has been a roughly 11-fold increase. The reasons for this dramatic rise in human-bear conflict are numerous and include:

- Wildlife protection efforts in the Chang Tang reserve in recent years have included the implementation of the 1993 and 2001 laws against killing wildlife and the 2001 reserve gun ban and firearms confiscation program. These efforts have contributed to a suspected small increase in the population of brown bears in the Chang Tang region in recent years and are believed to have emboldened brown bears which now have less to fear from humans. Thus these actions are thought to be in large part responsible for the increased occurrence of human-bear conflict in the survey area.
- Human, livestock, and bear numbers are all increasing in the survey area, leading to the increased potential for bears to come into conflict with humans and their livestock.
- With improved wildlife protection efforts in the reserve, there is now growing overlap between areas oc-

occupied by humans, bears and other wildlife, as increasing wildlife populations re-occupy the reserve's more productive southern grasslands, from which wildlife had largely been displaced by herders and their livestock in recent decades.

- Since the livestock privatization program began in the early 1980s, herd sizes have increased while simultaneously the size of production teams, now often a single family, have decreased. This has led to the reduced ability of each herder to adequately guard his livestock, thus increasing the likelihood of these domestic animals being killed by bears and other predators.
- As in the American west and elsewhere, bears in the Chang Tang have become increasingly habituated to subsisting by killing livestock and raiding human food supplies, and are increasingly dependent on human sources of food as opposed to their natural food base, the black-lipped pika (*Ochotona curzoniae*), upon which brown bears in the Chang Tang were almost entirely dependent prior to permanent settlement of the region by nomadic herders in the latter part of the 20th century (Schaller 1998a). Regrettably, many bear

cubs may no longer be learning to hunt pikas and marmots, which will only serve to perpetuate the problem of human-bear conflict in the Chang Tang region.

5.3 Bear Sightings by Herders

While herding households living constantly under threat of economic losses caused by bears, snow leopards, and wolves almost categorically exaggerate the threats these species pose to their livelihoods, in the case of a vast, little studied region such as the Chang Tang reserve, local herders are also one of the best sources of information concerning little seen predators and other wildlife species in the region. Thus herders' views on Tibetan brown bear populations in their home territories are of great interest to the wildlife researcher, some of which are discussed below.

When herders were asked if there were bears "in the vicinity" of their camps, the following responses were given (Table 5.6):

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Table 5.6. Bears in the vicinity of surveyed households.

Are there bears in the vicinity of your camp?	Number of Responses	Percentage of All Surveyed Households
Yes	278	92.7
No	21	7.0
Don't Know	1	0.3
Total	300	100

Of the 278 herders who responded yes to the above question, 275 gave the following reasons for how they knew there were bears in the vicinity of their camp (Table 5.7):

Table 5.7. Bears sightings and sign in the vicinity of surveyed households.

How do you know there are bears in the vicinity of your camp?	Number of Responses	Percentage of All Surveyed Households
Herder has seen them.	258	86
Other herders have seen them.	12	4
Herder has seen tracks or burrows.	4	1.3
Herder has seen bear damaged property.	1	0.3
Total	275	91.6

Survey results show that bear conflict is an extremely large problem for herders, and given that 93 percent of all respondents claimed to have bears living in the vicinity of

Human-Wildlife Conflict in the Chang Tang Region of Tibet

their camps, one could conclude that bears in the Chang Tang are, at present, not exhibiting much fear of humans. However, when asked if they had seen a bear in the past year, and if so, how many, herders gave the following responses (Table 5.8):

Table 5.8. Number of bears sighted in the past year (April 2005-April 2006).

Number of Surveyed Herders Seeing Bears in the Past Year (April 2005-April 2006)	Number of Times Bears Were Seen in the Past Year. (April 2005 -April 2006)
38	1
28	2
25	3
9	4
9	5
7	6
1	7
1	8
2	9
11	10
1	13
2	15
1	16
3	20
Total: 138 Herders	

From Tables 5.7 and 5.8, above, it is seen that while 258 herders have seen bears in the vicinity of their camps, only 138, 46 percent of herders surveyed, have done so in the past year, with 100 respondents claiming to have seen bears more than once in the past year, and seven respondents claiming to have seen bears in the vicinity of their camps more than 10 times in the past year. While the 138 herders sighting bears in the past year is far less than the 258 surveyed herders claiming that there are bears in the vicinity of their camps, it is still an extremely large number and gives an indication of the great potential for herders to come into conflict with bears.

5.4 Herders' Views on Bear Ecology

In addition to being asked about bear conflict and bear sightings, herders were also asked about their opinions on the state of bear ecology in the survey region, specifically on relative abundance of bears, whether they felt bear numbers were increasing, and what they felt were the main threats to bears today (Tables 5.9, 5.10, and 5.11).

Table 5.9. In the herder's opinion are bears rare, common, or abundant?

In the herder's opinion, are bears rare, common, or abundant?	10 Years Ago (percent)	Today (percent)	Change (percent)
Rare	26	3	- 23
Common	53.7	50	-3.7
Abundant	11	38.3	+27.3
Don't Know	9.3	8.7	-0.6
Total	100	100	

Table 5.10. In the herder's opinion are bear numbers increasing or decreasing?

In the herder's opinion, are bear numbers increasing or decreasing?	Number of Responses	Percentage of Respondents
Increasing	211	70.3
Decreasing	5	1.7
No Change	33	11
Don't Know	51	17
Total	300	100

From the results of the above two survey questions it is clear that the majority of herders surveyed in the Chang Tang feel that bears were common ten years ago, are much more abundant today than in the past, and that their numbers are increasing. However, given the low reproductive

rate of the Tibetan brown bear, the vast home range presumably needed to support a single bear in a low-productivity ecosystem like that of the Chang Tang reserve, and the booming international trade in bear gall bladder and other bear parts, it is highly unlikely that the Tibetan bear population has increased by more than a few percentage points since creation of the Chang Tang reserve in 1993. However, with the number of households experiencing human-bear conflict more than quadrupling in this same time period, it is not surprising that many local herders feel that bear numbers have increased rapidly over the past 13 years.

Many herders also stated that the hibernation period of bears in the Chang Tang has been getting shorter in recent years because human sources of food have become readily available to bears, whereas before bears remained dormant until frozen ground thawed in spring, permitting pikas to be dug out of their burrows. This lengthening of the annual period of bear activity has no doubt also contributed to the increased incidence of human-bear conflict and to the perception that bear numbers are increasing rapidly.

However, as discussed above, herders commonly exaggerate bear numbers since there is great economic incentive to kill bears to protect livestock and property, and because there is generally great resentment about the bear problem in the Chang Tang, with many survey respondents feeling that

brown bears are not in need of protected status and that the government is more concerned about bears than people. Such attitudes may, in the long run, be detrimental to protecting all types of wildlife in the Chang Tang.

Even more surprising though, is the general, possibly disingenuous, misperception of present threats to Tibetan brown bears shown by the responses to the following survey question (Table 5.11):

Table 5.11. Surveyed herders' opinions on threats to the survival of Tibetan brown bears.

In the herder's opinion, what are the threat to bears?	Number of Responses	Percentage
Lack of Food	139	46.3
No Threats to Bears Exist	106	35.3
Don't Know	49	16.3
Other	4	1.3
Humans Killing Them	2	0.7
Total	300	100

In spite of 82 percent of respondents replying that the biggest threat to bears in the Chang Tang was the lack of food or that no threats to bears exist, in the opinion of the authors, humans still pose the single largest threat to the continued survival of the Tibetan brown bear in the Chang Tang. Whether killed to protect livestock and property, due

to an economic need to earn extra money by selling bear parts, out of fear, or simply for sport, historical accounts indicate that the population of the Tibetan brown bear has plummeted throughout its range in the past century, and in the opinion of George Schaller, these bears are now "rare on the steppes" and mainly confined to mountainous terrain, which may explain the higher incidence of bear conflict in Shenzha County (Schaller 1998a).

However, the response to this question does reflect a tremendous need for wildlife conservation education programs in the Chang Tang and Seling Lake reserves, and an urgent need for implementing measures to reduce human-bear conflict, such as by improving food storage and camp sanitation, improving home and livestock corral construction, putting bear fences around living compounds, and possible relocation of livestock from areas experiencing exceptionally high human-bear conflict. Through such efforts to prevent brown bears from developing a preference for human foods and livestock it is hoped that financial losses to herders caused by bears can be reduced, and that the Chang Tang's bears can be "kept wild" and reliant on their natural food sources, primarily the black-lipped pika.

5.5 Selected Recent Reports of Bear Conflict

The following reports of human-bear conflict from

Shenzha and Nyima Counties are illustrative of the severity of the bear conflict problem in the Chang Tang region at the present time.

2003 - Shenzha County

One evening in Shenzha Township Village #7, three marauding brown bears entered the village and broke into 3 houses and 2 tents, destroying many items of furniture and consuming or destroying 4 sheep carcasses and 1172 kg of food stuffs. The bears also entered 2 sheep pens and killed 75 sheep (Source: Shenzha County Forestry Bureau Records).

April 2003 - Nyima County

On April 29, a 62 year old herder from Juncang Township Village #3 was returning home when he was attacked by a brown bear. He was bitten in the neck, had the skin torn off his face, and died. Adding to the tragedy was the fact that the herder was the sole provider for his small family which consisted of his mentally ill first wife, his disabled second wife, and his senile older sister. As the family was childless, no one was left to care for the family's yaks and sheep (Source: Nyima County Forestry Bureau Records).

August 2003 - Shenzha County

On the nights of August 3rd and 4th brown bears and a wolf killed 75 sheep and goats in Mayor Township Village # 2. A week later a brown bear entered the same village and killed 30 more sheep. Two nights later on August 13, a bear entered neighboring Mayor Township Village #3 and killed 19 sheep and goats. The total economic loss from these livestock kills was US \$2325 (Source: Shenzha County Forestry Bureau Records).

July 2004 - Shenzha County

On July 27th and 28th two brown bears entered Patsa Township Village #12 and killed 35 sheep and 25 goats (Source: Shenzha County Forestry Bureau Records).

September 2004 - Shenzha County

On the night of September 10th, a brown bear entered Shenzha Township Village #6 and broke into a herder's house by ripping off the roof, then proceeded to break furniture and eat dried meat resulting in US \$885 in damages (Source: Shenzha County Forestry Bureau Records).

April 2006 - Tsonyi County

Mr. Wanggyal, the governor of Parling Township, stated that "in the old days there were robbers to make our lives

uneasy, now we have brown bears to put our lives in danger. In Parling Township Village #2, a bear broke the windows of a house owned by a herder named Wangchok while people were sleeping inside. One herder named Najee can no longer stay at his pasture because a bear visits his house frequently and he has had to move to the township center. Another herder, Ganyi, ties his horse to the gate of his sheep pen because people believe bears are afraid of horses, and he now sleeps on the roof of his house" (Source: WWF April 2006 Wildlife Conflict Survey).

5.6 Killing of Tibetan Brown Bears in the Chang Tang Reserve

Killing of bears in the Chang Tang region is likely to have decreased significantly since the late 1990s due to bans on hunting and firearms in the Chang Tang and Seling Lake Nature Reserves, but from herder survey responses it is clear that the killing of bears continues to be a regular occurrence in and around these reserves (Photo 7). Bears have long been a prime target of local hunters, with government workers and soldiers shooting bears for sport in the 1960s and 70s, and later for gallbladder and bear paws that were sold in larger towns in the 1980s. However, since the establishment of the Chang Tang and Seling Lake reserves in 1993, hunting by non-herders is believed to have decreased

while killing of bears by herders defending their livestock and property is thought to have increased.

Although survey respondents were asked about bears killed by humans in their localities, given the penalties for doing so it is not surprising that few herders were willing to admit to killing bears themselves. However, survey respondents were much less reticent to talk about bears killed by third parties and many reported hearing of bears being killed by neighbors or herders in nearby townships. Given the hearsay nature of these reports and the fact that multiple neighbors often reported the same recent bear kill, it proved impossible to make an accurate estimate of the number of bears killed in the survey area in recent years. Nevertheless, with 39 survey respondents reporting seeing or hearing about killed bears since 2000, it is clear that the killing of bears in the survey area continues, and that Tibet's population of endangered Tibetan brown bears, which is unlikely to number more than perhaps 2800 animals in all of the TAR, continues to be threatened by humans (Wang 1998).

5.7 Section Summary

Human-brown bear conflict is a relatively new phenomena in the southern Chang Tang, which is largely the result of creation of the Chang Tang and Seling Lake Nature Reserves in 1993 and the subsequent ban on hunting and guns

in the vast territory of these reserves. Prior to creation of the reserves, herders often shot bears on sight out of fear, and, as a consequence, bears remained wary of humans. However, in a "Yosemite-type" situation, since creation of the reserve, establishment of penalties for killing reserve wildlife, and the confiscation of weapons, bears have quickly learned that there is now little to fear from humans and have become habituated to killing livestock and to raiding homes in search of flour, oil, and meat. At present, no one can control bears conditioned to feasting in homes and livestock corrals and herders are very emotional about the bear problem, which is causing many of them substantial economic losses directly as a result of newly created nature reserve policies. Thus more research and planning is needed to develop strategies to resolve the human-bear conflict issue in the Chang Tang reserve so that the majority of herders will continue to refrain from killing bears. With bear populations in the Chang Tang reserve now believed to be slowly increasing as a result of the 1993 reserve hunting ban, the 2001 firearms confiscation program, and increased access to high-calorie human foods, the problem of human-bear conflict in the Chang Tang is only likely to increase in the immediate future.

Part VI. Analysis of Wildlife Conflict with Other Species

The sub-sections which follow will provide brief overviews of human-wildlife conflict involving the remaining four species of large predators researched in this survey, as well as the issue of grazing competition conflict with wild ungulates.

6.1 Snow Leopard

With 24 percent of surveyed households reporting having experienced conflict with snow leopards since 1990, snow leopards are believed to be the second largest source of direct economic losses to herders residing in the vicinity of the Chang Tang and Seling Lake Nature Reserves after brown bears (Photo 8). Losses inflicted by snow leopards generally consist of the killing of a single sheep, goat, or yak, although occasionally snow leopards loose in sheep corrals have been known to kill multiple animals, with one herder in Shenzha County reporting the loss of 70 of his 400 sheep in one night in 2005 to what he believed were a pair of young snow leopards (Wei Dong, Personal Communication, Shenzha County Forest Police Office, May 2006).

The population of snow leopards throughout their range was estimated to be only 4000-7000 animals in the late 1990s, though sharp declines have been reported in much of the species' range since that time, making the snow leopard the single most endangered species in this study (Theile 2003). Extremely little is actually known about the Chang Tang's snow leopards, thus learning about the snow leopard population and distribution in the Chang Tang, as well as threats to these cats from the local herders, is a matter of utmost importance if the snow leopard is to be saved from extinction.

The following data concerning human-snow leopard conflict as a function of county, household type, living arrangement, and self-assessed economic status is excerpted from report sub-sections 4.2, 4.3, 4.4, and 4.5, above.

Table 6.1. Percentage of surveyed households having experienced snow leopard conflict since 1990 by county.

Species	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Snow Leopard	15	50	6	24

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Table 6.2. Percentage of surveyed households having experienced snow leopard conflict since 1990 by household type.

Species	Household Type		
	House	Tent	Mixed
Snow Leopard	18	18	30

Table 6.3. Percentage of surveyed households having experienced snow leopard conflict since 1990 by living arrangement.

Species	Living Arrangement	
	Group	Individual
Snow Leopard	27	16

Table 6.4. Percentage of surveyed households having experienced snow leopard conflict since 1990 by self-assessed economic status.

Species	Self-Assessed Economic Status		
	Poor	Middle Class	Rich
Snow Leopard	17	25	31

As with human-bear conflict, human-snow leopard conflict cut across all surveyed socio-economic factors, and seemed to be primarily a function of geographic location. However, in the case of snow leopard conflict, herd size also appeared to be a minor contributing factor, with larger herds being more likely to be attacked than smaller ones

Human-Wildlife Conflict in the Chang Tang Region of Tibet

(Tables 6.3 and 6.4). In terms of geography, with 50 percent of surveyed households in Shenzha reporting having experienced snow leopard conflict since 1990, the mountainous terrain of Shenzha County appears to be prime snow leopard habitat. In contrast, only 15 percent of survey respondents in Nyima County and just 6 percent of surveyed households in Tsonyi County reported experiencing conflict with snow leopards during the same time period (Table 6.1).

Surveyed "mixed" residence type households experienced snow leopard conflict at a much higher rate, 30 percent, than house and tent dwellers, 18 percent each, although mixed residences also constituted 62 percent of all households in Shenzha County, where most snow leopard conflict occurred (Table 6.2). Since it was not determined whether herders with mixed household types experienced snow leopard conflict while residing in their tents or in their houses, the author's can offer no speculation as to whether residence type influences the likelihood of a herding camp being prone to snow leopard conflict.

One possible factor that appears to increase the likelihood of herders experiencing snow leopard conflict is herd size. In this survey 27 percent of herders living in groups, with presumably much larger combined herd sizes than individuals, reported experiencing snow leopard conflict since 1990, as opposed to just 16 percent of herders residing a-

lone as individual families, though it should be noted that in Shenzha county, 88 percent of surveyed herders resided in groups (Tables 2.2 and 6.3). More telling perhaps is the fact that 31 percent of "rich" households and 25 percent of "middle-class" households experienced snow leopard conflict versus just 17 percent of self-described "poor" families, which presumably had smaller herds and a lower live-stock per household member ratio (Table 6.4). One explanation of this decreased risk is that this lower ratio probably facilitated a more vigilant watch over the few animals these families did own, although it should be noted again that many poor households simply pool their animals with the larger herds of wealthier families.

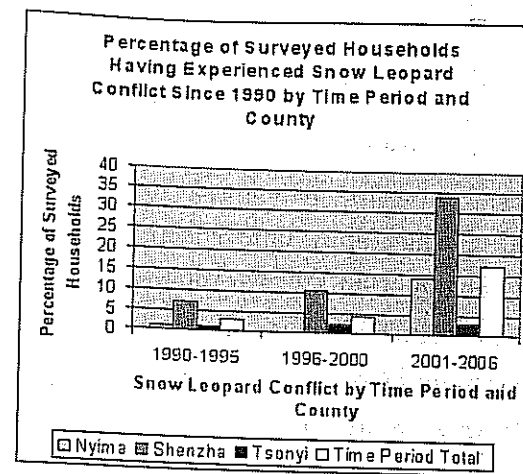
A time period analysis of snow leopard conflict yielded the following results (Table 6.5, Figure 6.1):

Table 6.5. Percentage of surveyed households having experienced snow leopard conflict since 1990 by time period and county.

Species: Snow Leopard	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Time Period				
1990-1995	1.1	7.0	1.2	3.1
1996-2000	0	10.4	2.1	4.2
2001-2006	14	34	3	17

Note: See Table 4.6 for the estimated number of extant surveyed households in each of the three survey time periods by county.

Figure 6.1. Percentage of surveyed households having experienced snow leopard conflict since 1990 by time period and county.



As with human-bear conflict, the above figure shows a dramatic increase in the incidence of human-snow leopard conflict since creation of the Chang Tang and Seling Lake Nature Reserves. In total, human-snow leopard conflict increased more than five times over the three survey time periods, with an over three-fold increase in the number of reported conflicts with snow leopards in Shenzha county, and a tremendous increase in Nyima County, from one reported snow leopard incident in the entire period from 1990 to 2000, to 14 between 2001 and 2006.

The reasons for this dramatic increase in human-snow leopard conflict closely parallel those for increases in hu-

man-bear conflict over the same period. These include creation of the Chang Tang and Seling Lake Nature Reserves in 1993, the subsequent hunting ban and campaign to confiscate guns and traps, as well as improved anti-poaching patrols in the reserves. With less to fear from humans, snow leopards are increasingly conditioned to relying on livestock as a primary food source as opposed to their traditional food base in the Chang Tang, blue sheep or bharal (*Pseudois nayaur*) (Schaller 1998a). An interesting question, then, is that of the status of blue sheep in the survey area and whether poaching of blue sheep by herders is driving snow leopards to rely on livestock, questions that were not addressed in the present survey. However, blue sheep populations in the greater Chang Tang region are believed to be stable or increasing, and prey species decline is not thought to be a major contributing factor to increased human-snow leopard conflict.

Clearly, increased human and livestock presence in snow leopard habitat is a major factor leading to increasingly frequent conflict with snow leopards, in particular along the base of ranges in mountainous Shenzha County. Thus, human encroachment on its habitat poses the largest threat to the continued survival of this species. While livestock protection is believed to be the primary reason why herders continue to trap and shoot snow leopards, there is, neverthe-

less, a large demand for the skins and parts of these animals which herders can readily sell, with there having been a large open trade in snow leopard skins, bones and other parts in the prefecture capital of Nagchu as recently as the mid-1990s. Thus sale of furs and parts may be as large a motivating factor in the retaliatory killing of snow leopards as protection of livestock (Photo 9).

Therefore, development of a strategy and policies for protecting snow leopards is of utmost importance in the survey area, and should include such measures as creation of a wildlife conflict compensation fund, a program to improve livestock corral design to prevent entry by snow leopards, and grazing set asides to maintain populations of blue sheep, the snow leopard's prey of choice in the Chang Tang. Recent reports of snow leopard conflict in the study area include the following:

May 2005 - Shenzha County

On the night of May 19th, a snow leopard entered Shenzha Township Village #3 and killed 13 sheep owned by the local livestock collective while the herder responsible for the sheep slept nearby in his house, causing the herder to lose about half his annual in-kind salary from the collective. A request for compensation was made to the Shenzha County Forest Police Office (Source: Shenzha County Forestry Bu-

reau Records).

April 2006 - Shenzha County

In a letter to the Shenzha County Forest Police Office dated April 18, 2006, the village council of Shenzha Township Village #3 stated that between March 10th and April 18th the village had lost 17 sheep and 4 goats to snow leopards. The author stated that the snow leopard population in the area was increasing and that many snow leopards now subsisted entirely on livestock (not verified). The letter requested that the forestry bureau investigate the situation and grant the villagers permission to fire a gun to scare snow leopards away (Source: Shenzha County Forestry Bureau Records).

April 2006 - Tsonyi County

A herder named Dorji from Tso Lho Township reported that on April 13th a snow leopard entered his village, jumped into a sheep pen and killed 11 sheep (Source: WWF April 2006 Wildlife Conflict Survey).

6.2 Wolf

Conflict with wolves was reported by 21 percent of surveyed households, making this issue nearly as large as that of snow leopards (Table 6.6, Photo 10). The following data

concerning human-wolf conflict as a function of county, household type, living arrangement, and self-assessed economic status is excerpted from report sub-sections 4.2, 4.3, 4.4, and 4.5, above.

Table 6.6. Percentage of surveyed households having experienced wolf conflict since 1990 by county.

Species	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Wolf	20	20	22	20.7

Table 6.7. Percentage of surveyed households having experienced wolf conflict since 1990 by household type.

Species	Household Type		
	House	Tent	Mixed
Wolf	22	12	20

Table 6.8. Percentage of surveyed households having experienced wolf conflict since 1990 by living arrangement.

Species	Living Arrangement	
	Group	Individual
Wolf	17	28

Table 6.9. Percentage of surveyed households having experienced wolf conflict since 1990 by self-assessed economic status.

Species	Self-Assessed Economic Status		
	Poor	Middle Class	Rich
Wolf	16	23	17

An interesting aspect of human-wolf conflict is that unlike conflict with bears, snow leopards, fox, lynx and wild ungulates, which all showed peak concentrations in specific counties, conflict with wolves appears to be occurring at fairly uniform rates throughout the study area, with 20 surveyed households in both Nyima and Shenzha Counties and 22 households in Tsonyi County reporting having experienced wolf conflict since 1990. As with bears and snow leopards, wolf conflict cut across all socio-economic factors surveyed, though house dwellers experienced conflict at higher rates than tent dwellers, at 22 percent versus 12 percent of surveyed house and tent dwellers, respectively, while individual households experienced conflict with wolves at a much higher rate than groups, at 28 percent and 17 percent of surveyed households, respectively. This may indicate that regardless of herd size, wolves prefer to prey on herding camps with minimal human activity (Tables 6.7 and 6.8). In terms of herd size, "poor" and "rich" households experienced wolf conflict at relatively equal rates at 16 percent and 17 percent respectively, while middle-class households were preyed upon at a slightly higher rate of 23 percent (Table 6.9).

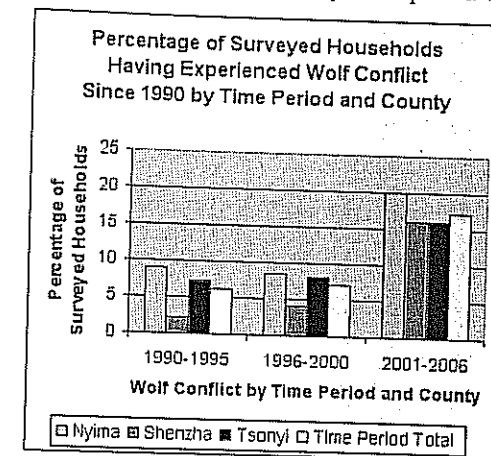
A time period analysis of human-wolf conflict yielded the following results (Table 6.10, Figure 6.2):

Table 6.10. Percentage of surveyed households having experienced wolf conflict since 1990 by time period and county.

Species: Wolf	County			
Time Period	Nyima	Shenzha	Tsonyi	Survey Total
1990-1995	8.9	2.3	7.3	6.2
1996-2000	8.4	4.2	8.3	7.0
2001-2006	20	16	16	17.3

Note: See Table 4.6 for the estimated number of extant surveyed households in each of the three survey time periods by county.

Figure 6.2. Percentage of surveyed households having experienced wolf conflict since 1990 by time period and county.



The above figure shows that among survey participants there has been a dramatic increase in the incidence of wolf conflict, 2.8 times over the three survey time periods, al-

though this increase is substantially less than the increase of 4.6 times for bear conflict and the increase of 5.5 times for snow leopard conflict during the same period. One other interesting item to note is that for the first two time periods, from 1990-1995 and 1996-2000, wolf conflict in Shenzha County was far lower than in Nyima and Tsonyi County, being only 37 percent and 60 percent of the survey average in these two time periods, respectively. Two possibilities that may explain this anomaly are that 1) prior to creation of the Chang Tang reserve in 1993 wolves were outcompeted by snow leopards for the same wild prey base in Shenzha County, and thus steered clear of the area, or 2) wolves simply avoided more mountainous habitat in favor of the open steppe prior to the hunting ban and the reduced risk of preying on domestic livestock.

Thus, although the distribution of conflict with the highly adaptable wolf is remarkably uniform over the area surveyed, the rate at which conflict between humans and wolves has increased since creation of the Chang Tang and Seling Lake reserves has been far lower than the rate of increase in bear and snow leopard conflict. One possible explanation for this lower rate of increase in human-wolf conflict involves the historical attitudes of Tibetans towards wolves, which are likely slow to change in spite of the reserve wide ban on hunting of all wildlife species.

Although one of the tenets of Buddhism requires the showing of compassion for all sentient beings, the hunting of wolves, and also foxes, has long been permitted by Tibet's Buddhist culture, even in "sealed areas" created by Buddhist monasteries, where hunting of all other wildlife was prohibited. In the past, local hunters in rural Tibet were known to carry wolf and fox pelts from door to door in their home villages in search of donations for their predator elimination efforts, which were considered to be of benefit to all herders in a village. Thus while all killing of wolves and foxes is prohibited in the reserve, because of long-ingrained attitudes against wolves and foxes, which Tibetan herders consider to be their traditional enemies, this prohibition may not be as rigorously enforced as the prohibition on killing other predators and wild ungulates in the reserve. So it appears that while the incidence of wolf and fox conflict is increasing, it is not increasing as rapidly as conflict with bears and snow leopards, possibly because the enforcement of laws concerning the killing of non-endangered species like wolves and foxes is not a high-priority for reserve rangers at the present time.

6.3 Fox

While causing no where near the levels of economic losses to herders as bears, snow leopards, and wolves, hu-

man-fox conflict is nevertheless a persistent problem for herders, particularly in Tsonyi County, with foxes inflicting losses on herders primarily in the form of lamb kills (Photo 11). The following data concerning human-fox conflict as a function of county, household type, living arrangement, and self-assessed economic status is excerpted from report sub-sections 4.2, 4.3, 4.4, and 4.5, above.

Table 6.11. Percentage of surveyed households having experienced fox conflict since 1990 by county.

Species	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Fox	9	7	24	13.3

Table 6.12. Percentage of surveyed households having experienced fox conflict since 1990 by household type.

Species	Household Type		
	House	Tent	Mixed
Fox	15	12	12

Table 6.13. Percentage of surveyed households having experienced fox conflict since 1990 by living arrangement.

Species	Living Arrangement	
	Group	Individual
Fox	11	18

Table 6.14. Percentage of surveyed households having experienced fox conflict since 1990 by self-assessed economic status.

Species	Self-Assessed Economic Status		
	Poor	Middle Class	Rich
Fox	11	15	9

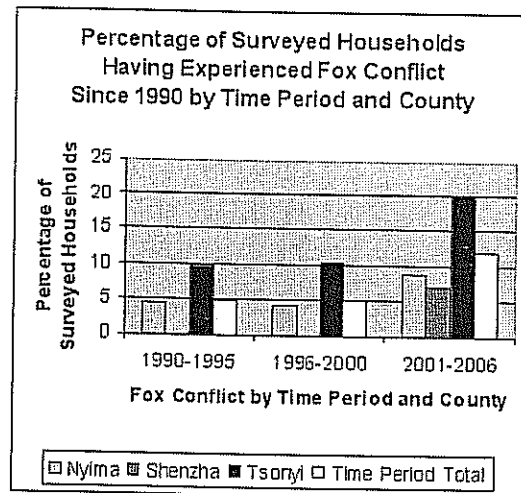
As can be seen from the above data, human-fox conflict cut across all surveyed socio-economic factors. As with bear and snow leopard conflict, fox conflict appeared to be largely a function of geographic location, with 24 percent of herders surveyed in Tsonyi County experiencing conflict with foxes, roughly three times the rate of households surveyed in Nyima and Shenzha Counties, making fox conflict a particularly large problem for Tsonyi residents. As with wolves, survey data indicate that fox appear to have a preference for taking livestock from individual families, as opposed to groups, and may have had a slight preference for raiding the camps of house dwellers as opposed to tent camps. Herd size does not appear to have been a leading factor in determining a household's likelihood of experiencing conflict with foxes.

A time period analysis of human-fox conflict yielded the following results (Table 6.15, Figure 6.3):

Table 6.15. Percentage of surveyed households having experienced fox conflict since 1990 by time period.

Species: Fox	County			
Time Period	Nyima	Shenzha	Tsonyi	Survey Total
1990-1995	4.4	0	9.8	4.7
1996-2000	4.2	0	10.4	4.9
2001-2006	9	7	20	12

Note: See Table 4.6 for the estimated number of extant surveyed households in each of the three survey time periods by county.

Figure 6.3. Percentage of surveyed households having experienced fox conflict since 1990 by time period and county.

As the above figure shows, the number of households experiencing human-fox conflict in the survey area has increased 2.6 times over the three survey time periods. As

with wolves, the rate of increase of fox conflict in the Chang Tang and Seling Lake reserves has been lower than that for bears and snow leopards, probably for the same reasons as for wolves, discussed in sub-section 6.2, above.

The problem of human-fox conflict involves both the red fox (*Vulpes vulpes*) and the smaller sand fox (*Vulpes ferilata*). However, herders in the survey area voiced much more tolerance for their local fox population than for their bears, snow leopards, and wolves, the perceived increased presence of which they vociferously resent. This is because the problem of loss of lambs to foxes is an age-old problem that pre-dates creation of the reserve. Thus herders find the occasional losses of lambs to fox expected and acceptable, and herders feel that despite the recent rise in human-fox conflict, the problem is not new, and simply indicates that they need to take better care of their lambs.

6.4 Lynx

Although limited in scope, with 15 out of 16 households reporting having experienced lynx conflict located in Nyima County, the problem is nevertheless significant for the protection of lynx in that county (Photo 12). The following data concerning human-lynx conflict as a function of county, household type, living arrangement, and self-assessed economic status is excerpted from report sub-sections

Human-Wildlife Conflict in the Chang Tang Region of Tibet

4.2, 4.3, 4.4, and 4.5, above.

Table 6.16. Percentage of surveyed households having experienced lynx conflict since 1990 by county.

Species	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Lynx	15	0	1	5

Table 6.17. Percentage of surveyed households having experienced lynx conflict since 1990 by household type.

Species	Household Type		
	House	Tent	Mixed
Lynx	5	12	5

Table 6.18. Percentage of surveyed households having experienced lynx conflict since 1990 by living arrangement.

Species	Living Arrangement	
	Group	Individual
Lynx	4	7

Table 6.19. Percentage of surveyed households having experienced lynx conflict since 1990 by self-assessed economic status.

Species	Self-Assessed Economic Status		
	Poor	Middle Class	Rich
Lynx	8	4	6

Human-Wildlife Conflict in the Chang Tang Region of Tibet

In Nyima County 9 of 55 surveyed households in U'chu Township reported having experienced lynx conflict since 1990 versus a slightly lower rate of 6 of 45 surveyed households in Nyima Township. Tents dwellers experienced lynx conflict at more than twice the rate of house dwellers and mixed households, though it should be noted that only 8 of the households surveyed in Nyima resided year-round in tents. As with wolves and foxes, individual households experienced lynx conflict at a much higher rate than herding households residing in groups. Herd size does not appear to be a contributing factor for lynx conflict, with poor households experiencing lynx conflict at twice the rate of middle-class households.

A time period analysis of human-lynx conflict yielded the following results (Table 6.20, Figure 6.4):

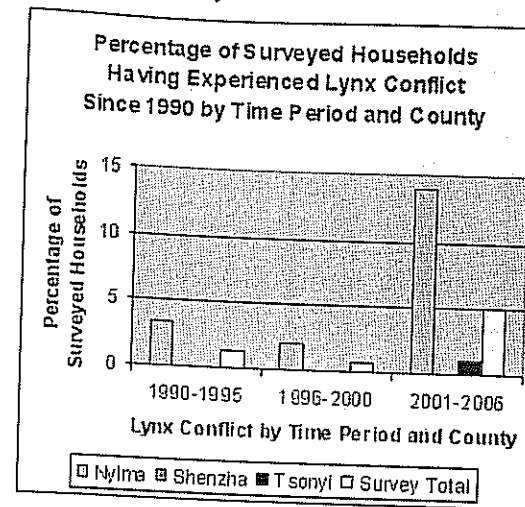
Table 6.20. Percentage of surveyed households having experienced lynx conflict since 1990 by time period and county.

Species: Lynx	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Time Period				
1990-1995	3.3	0	0	1.2
1996-2000	2.1	0	0	0.7
2001-2006	14	0	1	5

Note: See Table 4.6 for the estimated number of extant surveyed households in each of the three survey time periods by county.

From the below figure it can be seen that lynx conflict appears to be non-existent in Shenzha and Tsonyi Counties, where between the two counties only one household in Tsonyi has reported experiencing conflict with lynx since 1990. In contrast, the problem of lynx conflict in Nyima County, though still fairly limited, has grown over 4-fold since creation of the Chang Tang Reserve. Lynx are known to prey on domestic sheep and goats and prior to creation of the reserve had been heavily hunted for their pelts, which are popular for trimming traditional Tibetan clothing, particularly in the eastern Tibetan cultural area where lynx pelts are commonly found in clothing shops. The lynx is both rare and secretive, and at present the authors have no specific information on the status of the lynx in the Chang Tang and Seling Lake reserves and can offer no information on the rate at which these cats are being killed in the Chang Tang, though, anecdotally, several respondents reported knowing that a few lynx were being trapped annually in their areas.

Figure 6.4. Percentage of surveyed households having experienced lynx conflict since 1990 by time period and county.



6.5 Grazing Competition

While difficult to quantify, grazing competition conflict between domestic livestock and wild ungulates is an enormous problem throughout the settled areas of Tibet's Chang Tang region, affecting 36 percent of surveyed households, making it the second most common source of human-wildlife conflict in the survey area after Tibetan brown bears (Tables 4.1 and 6.21). The extremely thin, on average 85 percent bare, short growing cover of alpine steppe grasses in the northern TAR does not lend itself to haying for the purpose

of stockpiling winter fodder (Schaller 1998a). Thus herders with minimal financial resources have no other option but to reserve a large percentage of their allocated pasturage for winter use. Should one or several large herds of wild ungulates wander into the winter pasture and heavily graze it while the "owner" is away at summer camp, the possibility exists that there will not be sufficient fodder for the owner's domestic herds to survive the winter on. While a small number of better-off families in Shenzha County have begun to address this problem by fencing off their allotted winter pastures, as have a few other families receiving government support to do so, most herding families in the survey area do not have the financial resources to purchase fencing materials. From an ecological view point, this is fortunate, since extensive fencing of winter pastures, if carried out, would likely block the migration routes of all species of large wild ungulates in the Chang Tang, leading to the fragmentation of populations of these animals. Furthermore, extensive fencing is known to injure animals migrating at night, facilitate the poaching of Tibetan antelope - which can be trapped against fences before being killed, and can lead to widespread pasture degradation. Thus finding a method for resolving the grazing competition issue, preferably without fencing, is important for the continued coexistence and well-being of both wild and domestic ungulates in the Chang Tang

and Seling Lake reserves.

The following data concerning human-grazing competition conflict as a function of county, household type, living arrangement, and self-assessed economic status is excerpted from report sub-sections 4.2, 4.3, 4.4, and 4.5, above.

Table 6.21. Percentage of surveyed households having experienced grazing conflict since 1990 by county.

Species	County			Survey Total
	Nyima	Shenzha	Tsonyi	
Grazing Competition	63	11	35	36.3

Table 6.22. Percentage of surveyed households having experienced grazing competition conflict since 1990 by household type.

Species	Household Type		
	House	Tent	Mixed
Grazing Competition	41	35	32

Table 6.23. Percentage of surveyed households having experienced grazing competition conflict since 1990 by living arrangement.

Species	Living Arrangement	
	Group	Individual
Grazing Competition	33	43

Table 6.24. Percentage of surveyed households having experienced grazing competition conflict since 1990 by self-assessed economic status.

Species	Self-Assessed Economic Status		
	Poor	Middle Class	Rich
Grazing Competition	30	40	29

As with the Chang Tang predators discussed above, grazing competition conflict cut across all three surveyed socio-economic factors and appeared to be primarily a function of geographic location. In Nyima County, with its large population of Tibetan wild ass, which are cited by herders as the single biggest source of grazing competition conflict, 63 percent of all surveyed households reported experiencing grazing competition with wild ungulates. The great resentment of wild ass amongst Chang Tang herders may be because wild ass herds are highly visible, at times exceeding 500 in number, which are perceived to be a great threat to limited grazing resources in the low-productivity environment of the Chang Tang. In the course of one week in Nyima County, the WWF survey team saw two large wild ass herds along the road which were estimated to number 450 and 500 head each. Meanwhile, just 11 percent of surveyed households in mountainous Shenzha County reported experiencing grazing competition conflict, versus 35 percent of respondents in Tsonyi County.

Household type did not appear to be a factor, with 41 percent of house dwellers and 35 percent of tent dwellers experiencing grazing conflict, however a slightly larger difference was found between herders living in groups and individual households, with 33 percent of groups versus 43 percent of individuals reporting experiencing grazing competition conflict since 1990, which may indicate that some species of ungulates are more wary of humans, particularly of larger herding camps, as suggested by Fox and Bardsen 2005. With 30 percent, 40 percent, and 29 percent, of surveyed "poor", "middle-class," and "rich" households reporting having experienced grazing competition conflict since 1990, respectively, domestic herd size does not appear to be a large factor in determining the likelihood of a household experiencing grazing competition conflict.

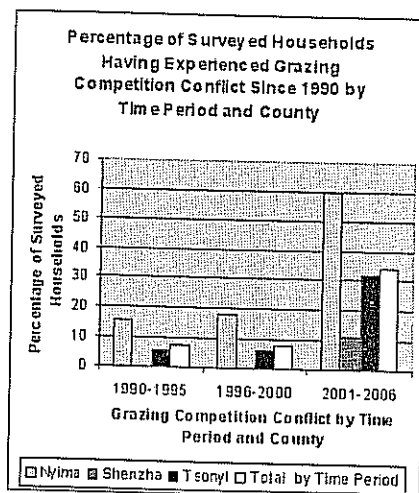
A time period analysis of grazing competition conflict produced the following results (Table 6.25, Figure 6.5):

Table 6.25. Percentage of surveyed households having experienced grazing competition conflict since 1990 by time period.

Grazing Conflict	County			Total by Time Period
	Nyima	Shenzha	Tsonyi	
Time Period				
1990-1995	15.6	0	6.1	7.3
1996-2000	17.9	0	6.3	8.0
2001-2006	60	11	32	34.0

Note: See Table 4.6 for the estimated number of extant surveyed households in each of the three survey time periods by county.

Figure 6.5. Percentage of surveyed households having experienced grazing competition conflict since 1990 by time period and county.



As the above figure shows, the incidence of grazing competition conflict in the survey area has increased by a factor of 4.7 since creation of the reserve, with grazing competition conflict in the most affected county, Nyima, increasing 3.8 times and grazing competition in Tsonyi increasing 5.2 times. In Shenzha, the southernmost county in the survey, none of the surveyed households reported experiencing grazing competition conflict between 1990 and 2000, while 11 percent of the same households reported experiencing grazing competition in the 2001 to 2006 time pe-

riod.

Reasons for the sharp, nearly 5-fold increase in the number of surveyed herding households experiencing grazing competition conflict are numerous and include:

- Creation of the Chang Tang and Seling Lake Nature Reserves and subsequent implementation of wildlife protection practices in these areas, such as implementation of the 1993 and 2001 laws against killing all wildlife species and the 2001 reserve gun ban and weapons confiscation program. These actions have led to increases in the reserves' wild ungulate populations over the past five years, and in all likelihood have also contributed to the increased occurrence of human-grazing competition conflict in the survey area (Schaller et al. 2005).
- At the same time that populations of wild ungulates in the survey area have been increasing, livestock numbers have also grown, doubling since the 1960s (e.g. see Schaller et al. 2005). Because of the increases in wild ungulate populations over the past six years and the reduced fear these animals have of humans resulting from the hunting ban, both Tibetan wild ass and Tibetan gazelle appear to be increasingly unafraid of humans and conditioned to living in close proximity with them (Fox

and Bardsen 2005). Thus, as with the reserves' predators, there is now increased overlap between areas occupied by humans and their livestock and widely roaming herds of wild ungulates, as these wild herds reoccupy the reserve's more productive southern grasslands, from which much wildlife had been largely displaced by herders and their livestock in recent decades. Consequently wild ungulates are coming into increasingly frequent competition with domestic livestock for the region's extremely limited grass resources, while herders are prohibited by law from taking retaliatory action against these expanding wild herds.

- With privatization of livestock in the Chang Tang beginning in the early 1980s, herd sizes have increased while simultaneously the size of production teams, now often a single family, have decreased, making it increasingly difficult for herders with larger workloads to adequately protect their vacant winter pastures from roaming wild ungulates in summer.
- While collectively held livestock in the Chang Tang was privatized in the early 1980s, pasture lands nominally remain property of the state. However, while pasture rights were granted collectively on a village by village

basis prior to 2001, in that year pasture rights in the Chang Tang reserve region began being allocated to individual families. Thus with each family being consigned a specific amount of pasture land, these families are now more conscious of intrusion by wild herds of ungulates on their pasture allocation. While concern over loss of grass resources to wild ungulates on communally held village pastures had been muted by villagers abilities to shift their animals to different areas, loss of grass resources to wild ungulates can now bring great economic hardship to individual households living in a marginal environment like the Chang Tang steppe, whereas before losses were absorbed more equally amongst all families in a village. Thus herders today have a heightened awareness of intrusion by wild ungulates on their families' private pastures, which may account for some of the increase in reported incidence of grazing competition over the past five years.

Populations of the main species of wild ungulates in the Chang Tang Nature Reserve as estimated by Schaller in 1998 are found below (Table 6.26), followed by a brief look at how Chang Tang herders perceive the problem of grazing competition conflict with each of these individual species.

Table 6.26. 1998 population estimates for the main ungulate species in the Chang Tang Nature Reserve (rounded to the nearest 1000).

Species	Latin Name	Estimated Population in 1998
Tibetan Wild Ass (Kiang)	<i>Equus kiang</i>	25,000
Tibetan Antelope (Chiru)	<i>Pantholops hodgsoni</i>	37,000
Tibetan Gazelle	<i>Procapra picticaudata</i>	20,000
Blue Sheep (Bharal)	<i>Pseudois nayaur</i>	10,000
Wild Yak	<i>Bos grunniens</i>	8,000

Source: Schaller 1998a and 1998b.

Note: Populations of all of the above species in the Chang Tang National Nature Reserve are believed to have increased, some substantially, since these numbers were compiled (Schaller et al. 2005).

Tibetan Wild Ass (Kiang)

From the 1960s to the 1980s, prior to the creation of the Chang Tang and Seling Lake Nature Reserves, the Tibetan wild ass was widely hunted for meat by both subsistence and commercial hunters, as well as for sport (Photo 13). Today, the wild ass is considered by herders to be the largest source of competition with domestic livestock for the region's limited grass resources. While wild ass are outnumbered by Tibetan antelope in the region, and occur in numbers similar to the Tibetan gazelle, Tibetan antelope and gazelle tend

to move in much smaller herds than wild ass, with Tibetan antelope typically moving in groups of 20 or less, though rarely in groups numbering in the 80s, while Tibetan gazelle move in herds numbering up to 25, though more typically in smaller groupings (Table 6.26, Schaller 1998a). The Tibetan wild ass, however, though most often moving in small herds, often gathers into groups of several hundred or more, as the WWF team observed on two occasions in Nyima County in April of 2006. Thus while not the most numerous of the wild ungulates in the Chang Tang, because of the large numbers they sometimes move in, the Tibetan wild ass is perceived by local herders to be the biggest threat to grass resources intended for domestic livestock. Herders also report that in early spring wild ass dig grassroots for forage in areas where winter grass is exhausted, a behavior which is highly destructive of pasture resources and causes further resentment against this species among affected herders.

While herders now admit to chasing Tibetan wild ass from their pasture allotments on motorcycle, it is not believed that killing of wild ass by herders seeking to protect their grass resources is a significant problem at the present time. However, stories of hunters poaching male wild ass for its penis, which is believed to enhance sexual performance when eaten, began to circulate around Nyima County in early 2006. Nevertheless, herders have been so vocal in

their complaints against the Tibetan wild ass, that county government officials have proposed culling wild ass in the Chang Tang reserve to reduce grazing conflict with domestic livestock. In December of 2000, the Nyima County government filed a request with the Nagchu Prefecture government, Animal Husbandry Bureau, and Forestry Bureau to cull 4000 Tibetan wild ass annually, citing grazing competition with livestock and grassland degradation as the justification. In the request it was stated that the Kiang population had "doubled" to 63,450 (not verified) since creation of the Chang Tang Reserve in 1993, and that only old or unhealthy wild ass would be culled, with meat and skins being distributed to poor households in Nyima County, and any proceeds from their sale being used for grassland management, human-wildlife conflict compensation, and poverty relief programs. Permission was not granted because culling would have violated multiple wildlife protection laws and regulations (Source: Nyima County Forestry Bureau Records).

Tibetan Antelope (Chiru)

While Tibetan antelope are the single most populous wild ungulate species in the Chang Tang reserve, herders in the reserve do not consider them to be a particularly large source of grazing competition (Photo 14). As mentioned above, Tibetan antelope tend to move in smaller groups than Tibetan wild ass, and are more wary of humans, probably a result of the mass slaughter of these animals for the shahtoosh shawl trade in the 1980s and 1990s (Fox and Bardsen 2005). Furthermore, female antelope migrate to calving grounds in the uninhabited remote northern Chang Tang in July and August, far from the southern winter pastures of nomadic herders (Ridgeway 2005). Thus unlike the wild ass, herders do not perceive the Tibetan antelope as a large threat to their livelihoods, though Tibetan antelope continue to be poached heavily for the shahtoosh trade.

Tibetan Gazelle

Although the numbers of Tibetan gazelle in the Chang Tang reserve are on par with those of the Tibetan wild ass, local herders do not consider gazelle to be a particularly large threat to their livelihoods (Photo 15). Like the Tibetan wild ass, Tibetan gazelle often graze in close proximity to herding camps and are frequently seen along roads across the Chang Tang. However, as with Tibetan antelope, Tibet-

an gazelle move in smaller herds than the Tibetan wild ass, and are thus perceived to be a smaller source of grazing competition than the wild ass.

Blue Sheep (Bharal)

Blue sheep, also known as Himalayan blue sheep or bharal, are locally common in mountainous areas of the Chang Tang, where in places they are the most abundant wild ungulate (Schaller 1998a, Photo 16). Having a preference for relatively gentle, grassy slopes, they are a significant source of grazing competition for the domestic herds of mountain dwelling nomads, and in this study blue sheep were only reported as a source of grazing competition conflict by herders in mountainous Shenzha County.

Wild Yak

There are few wild yaks remaining in populated areas of the southern Chang Tang, having been hunted relentlessly throughout the past century for meat and to prevent wild yak bulls from mixing with domestic yak herds (Photos 17 and 18). As with Tibetan gazelle and antelope, wild yaks move in small herds, typically averaging 25 or fewer animals, while many yak bulls live solitary existences, though on occasion in the remote western Chang Tang aggregations of over 200 wild yaks have been seen (Schaller 1998a). Thus

in the survey area wild yaks were not seen as a large source of grazing competition conflict. However, wild yak bulls were considered to be a large threat to the livelihood of herders because they frequently approach domestic herds in search of harems, and annually drive off large numbers of female domestic yaks to remote areas that could otherwise be sold for US \$250 to US \$400 each (Tables 8.1 and 8.2, below). In addition to losing domestic yaks in this way, wild yaks are also known to charge herders on the open steppe, at times inflicting great bodily harm and occasionally killing their victim (Table 8.4, below). Consequently, many herders consider wild yaks to be a greater threat to their livelihoods and safety than even the Tibetan brown bear, giving herders great motivation to kill wild yak bulls when they approach herding camps.

One recent recorded case of human-yak conflict occurred in October 2004 in Nagchu Prefecture's Tsonyi County, where a herder reported that on October 20th, a wild yak bull without a harem came to his pasture and drove off all six of his female yaks to meadows high in a neighboring mountain range. He tried for the next four days to retrieve them but was kept back by the threatening behavior of the wild yak. The herder asked the advice of a passing forestry bureau official who suggested that he shoot his six female yaks, so that he could at least recover the meat and

skins. However the next day, all seven yaks had left the area and the six domestic yaks were never recovered, spelling financial disaster for the herder (Source: WWF 2004 Field Trip Notes).

Tibetan Argali

Although Tibetan argali (*Ovis ammon hodgsoni*), the Tibetan bighorn sheep, are found in the Chang Tang Nature Reserve, the population is apparently so small and dispersed in the survey area that none of the herders surveyed reported experiencing grazing competition conflict with this species (Photo 19).

Options for dealing with the problem of grazing competition conflict with these widely roaming wild herds are limited. In the past, these grazers were simply shot for both meat and to save limited winter grass reserves for domestic herds. Although this practice was banned with the establishment of the nature reserves, as noted above county officials have called for the systematic culling of large herds of Tibetan wild ass to preserve much needed grass resources for domestic herds. While at present herders are chasing wild ungulates off of their pasture lands on motorcycle, a more permanent, yet costly and ecologically damaging solution to the problem of grazing competition has been to fence off winter

pastures to exclude roaming wild ungulates. However, this option is creating new ecological problems, such as blocking the lengthy migration routes of species such as the Tibetan antelope, injuring wild animals unaccustomed to fences, creating barriers that facilitate poaching, and causing pasture degradation. Better options for dealing with grazing competition issues might be to post a guard year round at winter pastures to prevent entry by wild herds during summer months, or simply relocating winter pastures to areas not frequented by large wild herds, such as the Tibetan wild ass.

Part VII. Herder's Views on Human-Wildlife Conflict

In addition to questions on their socio-economic background and wildlife conflict they had experienced, herders were also asked about their views on the causes of human-wildlife conflict, possible solutions to this problem, and reasons why wildlife should be protected. Their responses are tabulated in Tables 7.1, 7.2, and 7.3 below, which show a dire need to educate herders about the possible causes of and solutions to the problem of human-wildlife conflict, as well as an urgent need to educate residents of the Chang Tang about the purpose of, need for, and potential benefits of effective wildlife conservation measures in northern Tibet.

Herder's responses concerning the causes of human-wildlife conflict were as follows (Table 7.1):

Table 7.1. Surveyed herders' opinions on the causes of human-wildlife conflict.

In the herder's opinion, what are the causes of human-wildlife conflict?	Number of Responses	Percentage of Respondents
Don't know.	160	53
Lack of food.	85	28
Too many bears.	30	10
Wild animals conditioned to eating human food.	21	7
Poor care of houses and sheep.	4	1
Total	300	100

From the Table 7.1, above, it can be seen that the majority of surveyed herders, 53 percent, responded that they did not know the basic causes of human-wildlife conflict, while 28 percent felt the cause was a lack of food for wild animals, and a further 10 percent felt the problem was simply that there were too many bears, both basic misconceptions. Thus, in total, 91 percent of surveyed herders were unaware of actual root causes of human-wildlife conflict, such as humans occupying wildlife habitat, livestock competing with wild ungulates for limited grass resources leading to a reduction in the wild prey base of predators, wild animals becoming conditioned to the ease of obtaining high caloric content food from human encampments, poor vigilance over herds, and poor construction of livestock pens. Only 8 percent of survey respondents were able to cite accurate, if

Human-Wildlife Conflict in the Chang Tang Region of Tibet

only partial, reasons for the causes of human-wildlife conflict, including 7 percent who cited wild animals being conditioned to eating human food and just 4 of 300 respondents citing herder fault in poor care of houses and sheep as a cause of human-wildlife conflict.

When asked to comment on a series of possible solutions to human-wildlife conflict, the following responses were given (Table 7.2):

Table 7.2. Surveyed herders' opinions on workable solutions to human-wildlife conflict.

In the herder's opinion, which of the following are workable solutions to human-wildlife conflict?	Number of Positive Responses per 300 Survey Respondents	Percentage of Positive Responses per 300 Survey Respondents
Don't know.	133	44
Kill wildlife.	104	35
Fence off house and pen areas.	44	15
Provide compensation.	35	12
Improve quality of houses and pens.	6	2

As with the previous question concerning causes of wildlife conflict, the surveyed herders most common response when asked about possible solutions to the human-wildlife conflict problem was simply that they didn't know, accounting for 44 percent of the total. The most popular solution expressed by 35 percent of survey respondents was to

Human-Wildlife Conflict in the Chang Tang Region of Tibet

simply kill the problem wildlife, an option that was banned with creation of the Chang Tang and Seling Lake Nature Reserves. In terms of potentially workable solutions, only 15 percent of survey respondents felt fencing off house and pen areas to keep wildlife out would be of help, while only 2 percent of respondents felt that improving the quality of houses and pens to prevent entry by wildlife would be of help. Just 12 percent of survey respondents felt providing compensation to victims of human-wildlife conflict would be of benefit.

When herders were asked why wild animal species that cause conflict with herders should be protected, the following responses were given (Table 7.3):

Table 7.3. Surveyed herders' opinions on why wildlife species that cause conflict with herders should be protected.

In the herder's opinion, why should wildlife that cause conflict be protected?	Number of Responses	Percentage of Respondents
Don't know.	181	60
For future generations.	32	11
Wildlife is part of the nation's natural heritage.	30	10
Wildlife shouldn't be protected.	29	10
Wildlife adds scenic beauty to the landscape.	14	5
To protect biodiversity.	8	3
Killing wildlife is against Buddhist teachings.	6	2
Total	300	100

Again, as with questions concerning the causes and solutions of human-wildlife conflict, when herders were asked about why wildlife species causing conflict with herders should be protected, an overwhelming 60 percent said they didn't know, while a further 10 percent insisted that these species shouldn't be protected at all. However, the remaining 30 percent of respondents gave diverse and knowledgeable responses on the reasons for wildlife protection, including "for future generations" with 11 percent, "for the nation's natural heritage" with 10 percent, "to add to the scenic beauty of the landscape" with 5 percent, and "to protect biodiversity" with just 3 percent. Yet in spite of most of the respondents being devout Buddhists, only 2 percent of surveyed herders cited Buddhist teachings as a reason for protecting wildlife.

Thus from the largely uninformed responses to the above three survey questions it can easily be concluded that there is an immediate need for a sweeping wildlife conservation education program to educate herders living in and around the Chang Tang and Seling Lake Nature Reserves about the purpose of these reserves, the purpose and benefits of wildlife conservation, the causes of human-wildlife conflict, and methods for reducing or eliminating various forms of this conflict.

Just as telling about the need for a region-wide wildlife

conservation education campaign were the responses to the following question concerning hunting (Table 7.4):

Table 7.4. Percentage of herders admitting to have killed wild animals that have attacked livestock.

Have you ever killed any wild animals that have attacked livestock?	Number of Responses	Percentage of Respondents
Yes	82	27
No	218	73
Total	300	100

In spite of the killing of wildlife in the reserves having been illegal and punishable by both fines and prison sentences since 1993, 27 percent of respondents freely admitted to having killed wild animals they believed to be threatening their livestock at some point in their lifetimes, although in all likelihood the actual number is probably significantly higher. This may indicate how deeply the tradition of hunting runs in the Chang Tang and how difficult it will be to eliminate completely.

While this marks the end of analysis of data gathered during the April 2006 WWF Human-Wildlife Conflict Survey, the sections which follow examine region-wide data on human-wildlife conflict and briefly discuss other threats to

wildlife in the Chang Tang and Seling Lake reserve areas, specifically commercial poaching, unregulated economic development in the reserves, and lack of funding for reserve management.

Part VIII. Additional Conflict Data and Analysis

8.1 County Human-Wildlife Conflict Data

In addition to data gathered in the April 2006 WWF Human-Wildlife Conflict Survey, the forestry bureaus of the counties that overlap the Chang Tang and Seling Lake Nature Reserves have all collected township-level data on human-wildlife conflict since at least 2001, with a few townships having records dating back to 1998, some of which are excerpted in Tables 8.1, 8.2, 8.3, and 8.4, below. These records detail economic losses to herders caused by wildlife and are presently being used to assist in developing a system of compensation for victims of wildlife conflict that is hoped will discourage the retaliatory killing of the reserves' large fauna.

Table 8.1, below, contains 2005 wildlife conflict data for all 6 counties that overlap the Chang Tang Nature Reserve as well as for Shenzha County which overlaps the Seling Lake Nature Reserve. As the annotations indicate, the data is incomplete, with some townships not reporting data while others only report on certain species, an indication of the need to standardize collection of wildlife conflict data in

reserve counties and townships. However, the data reported is indicative of the magnitude of the human-wildlife conflict problem in and around the Chang Tang and Seling Lake Nature Reserves, and is of interest for developing strategies and policies to reduce this conflict and hence the potential for retaliatory killing of the reserves' wildlife.

In general, sheep and goats are being killed by Tibetan brown bear, snow leopard, wolf, lynx, and fox, although sheep kill data in Table 8.1 is limited to those killed by bears, with one county each reporting sheep killed by snow leopards and wolves. Domestic yaks, particularly calves, may be killed by snow leopards, wolves and lynx, though many domestic yaks are simply "driven off" by wild yak bulls in search of harems and never recovered. Houses are only known to be damaged by bears in the process of raiding human foodstuffs. No other species is known raid human foodstuffs kept indoors. Most reported attacks on humans are by bears, though on occasion herders are also attacked by wild yaks.

Based on reported data, Shenzha County is clearly the county in the study area with the most severe wildlife conflict problem, with 311 households reporting 3894 sheep and goats killed by bears and snow leopards in 2005, more than twice the next highest total of 1825 killed sheep and goats in Tsonyi County. Shenzha County also had the high-

est number of domestic yaks killed or driven off with 97, nearly twice the total of the next highest county, Rutok, with 50 yaks killed or driven off. However, Amdo County with 204 rooms damaged by bears and a reported 94,907 kg of foodstuffs lost to these animals far exceeded Shenzha County's 107 damaged rooms and 10,252 kg of lost food stuffs. In total, 20 herders were attacked by wildlife in reporting counties in 2005, primarily by bears, five of which were in Gertse County, with four each in Shenzha and Rutok Counties. The one reported human death from wildlife attack in 2005 occurred in Tsonyi County, where a herder was killed by a wild yak (Table 8.4). Partial annual wildlife conflict data for the two counties with the highest reported number of households affected by wildlife conflict in 2005, Shenzha and Nyima Counties, is given in Tables 8.2 and 8.3, below.

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Table 8.1. 2005 Human-wildlife conflict data for reporting townships in 7 counties overlapping the Chang Tang and Seling Lake National Nature Reserves as ranked by number of households experiencing conflict.

County and Prefecture	Number of Townships Reporting and Species *	Total Number of Households in Reporting Townships	Number of Households Experiencing Wildlife Conflict	Sheep and Goats Killed	Yaks Killed or Driven Off	Rooms of Dwellings Damaged **	Foodstuffs Lost to Wildlife (kg) ***	Number of Humans Attacked
Shenzha, Nagchu	8 of 8 Bear, Snow Leopard, Wild Yak	2731	311	3894	97	107	10,252	4
Nyima, Nagchu	14 of 14 Bear Only	4981	290	1176	0	198	16,074	1
Tsonyi, Nagchu	7 of 7 Bear, Wild Yak	1781	228	1825	24	152	32,443	3
Amdo, Nagchu	13 of 13 Bear Only	6712	160	745	0	204	94,907	1
Rutok, Ngari	1 of 5 Bear, Wild Yak	151	33	284	50	21	0	4
Gertse, Ngari	3 of 8 Bear, Wild Yak, Wolf	532	26	304	6	37	320	5
Gegyal, Ngari	1 of 5 Bear, Wild Yak	105	5	0	3	0	0	2
Reported Totals	Townships: 47	16,993	1053	8228	180	719	153,996	20

Source: County forestry bureaus

* Note: Reporting townships from Ngari Prefecture were: Rutok County; Dongru Township; Gertse County: Drakbu, Dongtso, and Gumu Townships; Gegyal County: Gegyal Township.

** Note: The number of rooms damaged exceeds the number of households experiencing conflict in some counties because some herding households own permanent houses in both their summer and winter camps, while other families reported single homes being damaged more than once in 2005.

Human-Wildlife Conflict in the Chang Tang Region of Tibet

* * * Note: Foodstuffs counted included meat, flour, grain, animal fat and butter.

Table 8.2. 2000 to 2005 Shenzha County bear and snow leopard conflict data.

Year	Sheep and Goats Killed	Yaks Killed or Driven Off	Rooms of Dwellings Damaged	Foodstuffs Lost to Wildlife (kg)
2000	1138	9	18	3720
2001	1264	13	29	4243
2002	1389	25	41	5067
2003	1453	32	59	5961
2004	1579	47	71	6394
2005	3894	97	107	10,252
Totals	10,717	223	325	35,636

Source: Shenzha County Forest Police Office

Table 8.3. 1999 to 2005 Nyima County bear conflict data from 10 of 14 townships for which complete annual data exists.

Year	Households Affected	Sheep and Goats Killed	Foodstuffs Lost to Wildlife (kg)	Rooms of Dwellings Damaged	Monetary Loss (US \$)
1999	120	892	3181	47	19,361
2000	170	1236	4533	56	24,730
2001	158	1298	6005	77	26,681
2002	128	905	4820	66	17,196
2003	196	1523	5708	98	28,204
2004	173	991	7074	77	26,056
2005	272	1067	15,685	190	40,131
Totals	1217	7912	47,006	611	182,359

Source: Nyima County Forestry Bureau

Note: Includes data from the following townships: Asur, Jago, Wenbu, Drongsang, Drowa, Chuntsang, Nyima, Shenyra, Laido, and Dranyi. The following townships did not have complete annual records and were therefore omitted from this table: Jee-wa, Dargo, Ngochu, and Rongma.

The important thing to note about Tables 8.2 and 8.3 above is the steady increase in economic losses resulting from wildlife conflict over the 6 to 7 year periods given for Shenzha and Nyima Counties respectively, and the particularly sharp increases which occurred in both counties between 2004 and 2005. In Shenzha County increases in wildlife conflict between 2004 and 2005 saw the reported number of

goats and sheep killed soaring from 1579 animals to 3894 animals, the number of yaks being killed or driven off more than doubling from 47 to 97, the amount of foodstuffs lost increasing from 6394 kg to 10,252 kg, and dwellings damaged increasing from 71 incidents to 107 incidents. In Nyima County, increases in wildlife conflict between 2004 and 2005 were nearly as dramatic, with the number of households reporting conflict increasing from 173 to 272, foodstuffs lost more than doubling from 7074 kg to 15,685 kg, number of dwellings damaged increasing from 77 incidents to 190 incidents, and annual dollar loss increasing from US \$26,056 to US \$40,131. However, between 2004 and 2005 sheep and goat kills only increased marginally in Nyima County, from 991 head to 1067 head.

From the above three tables it can be seen that the economic losses resulting from human-wildlife conflict can deal a severe financial blow to the affected herding families, many of which only have annual incomes on the order of US \$400. While wildlife attacks on herders themselves appear to be increasing, with 20 reported wildlife attacks on herders having been reported in the seven-county study area in 2005, herder deaths resulting from these attacks continue to be relatively rare but regular occurrences (Table 8.1, 8.4). In the eight-year period from 1998 to 2005, only three of the seven reserve counties under examination reported herd-

er deaths resulting from wildlife attacks, with 7 deaths in total, 5 caused by Tibetan brown bears and 2 caused by wild yaks (Table 8.4). By way of comparison, in Alaska, which has a much larger area and human population than the study area, from 1900 to 2002 there were 56 recorded human deaths caused by bear attacks (Smith 2003).

Table 8.4. Humans killed by Tibetan brown bears and wild yaks in counties overlapping the Chang Tang and Seling Lake Nature Reserves from 1998 to 2005.

Year	County			Annual Totals
	Nyima	Tsonyi	Amdo	
1998	1-Brown Bear			1
1999	1-Brown Bear			1
2000	1-Brown Bear	1 - Wild Yak		2
2001				0
2002			1-Brown Bear	1
2003	1-Brown Bear			1
2004				0
2005		1 - Wild Yak		1
County Totals	4	2	1	7

Source: County forestry bureaus

From 1998 to 2005, no herder deaths resulting from wildlife attacks were reported in the following Chang Tang reserve counties: Rutok, Gegyal, and Gertse Counties of

Ngari Prefecture. In spite of being the county most severely affected by conflict with bears and snow leopards, Nagchu Prefecture's Shenzha County reported no deaths from wildlife attacks in the period from 1998 to 2005.

Thus the incidence of human-wildlife conflict throughout the Chang Tang region is clearly on the rise for the reasons discussed above in Parts V and VI, with the dramatic surges in human-wildlife conflict being recorded between 2004 and 2005.

8.2 Additional Human Wildlife Conflict Investigations

In addition to the interviews conducted for this survey and analysis of county data, the present interpretation of data has been influenced by WWF's work on the ground in the Chang Tang Nature Reserve since 1998. WWF's efforts during this time have included:

- 7 site visits to the Chang Tang Reserve from 2001 to 2006;
- 6 workshops organized on human-wildlife conflict issues from 2002 to 2005;
- Numerous group discussions, with rangers, officials, and local herders;

- A WWF-funded Ngari Prefecture bear conflict survey conducted by the Ngari Prefecture Forestry Bureau in 2006;
- A WWF-funded Nyima County bear conflict survey conducted by the Nyima County Forestry Bureau in 2005.

Part IX. Other Conservation Challenges in the Chang Tang

9.1 Illegal Poaching

Just a few years ago, poaching was by far the most pressing threat to the Chang Tang region's wildlife. Although much progress has been made in halting the killing and trade of the Chang Tang's threatened wildlife since the slaughter of the Tibetan antelope first came to international attention in the mid-1990s, in the course of conducting the survey it was seen that poaching continues, not only by organized poaching rings, but also in large part by or with the help of individual herders.

The nomads living inside Chang Tang Nature Reserve are among the poorest people in the TAR, with a total dependence on their livestock to survive. Their often remote and sparsely inhabited locations drastically limit their access to normal government services such as healthcare, education, veterinary services, and general development information. Recently all hunting activities in the Chang Tang reserves, including subsistence hunting, have been banned, cutting off an important source of meat and income for herders without compensation. Thus supplementing herding in-

comes by participating in the illegal wildlife trade remains a large temptation for many (Photo 20).

Reasons why commercial poaching persists in the Chang Tang despite local, national, and international efforts to halt the killing of wildlife are numerous. Economics remains the primary reason for the continued slaughter of Tibetan antelope. The wool, or "shahtoosh", of the Tibetan Antelope is the finest in the world and in high demand for northern India's shahtoosh shawl industry (Schaller 1998a, Ridgeway 2005, Wright and Kumar 1997). A single shawl requires the wool of three to five Tibetan antelope and can be sold in the west for anywhere from US \$7,000 to US \$15,000, depending on quality, and it is estimated that 20,000 Tibetan antelope were slaughtered annually for their wool during the 1980s and early 1990s (Schaller et al. 2005). While market demand for shahtoosh in the west has decreased due to a high profile campaign against this trade, it is thought that demand in India is increasing with the rapid rise of India's middle class, where the wearing of shahtoosh is a centuries old tradition. Consequently, with a typical Chang Tang herding family earning US \$400 per year in the livestock trade, but able to sell poached antelope skins for about US \$125 each, there is tremendous motivation to participate in the antelope skin trade (Photo 21). And although firearms were banned and confiscated from herders in

the Chang Tang Nature Reserve in 2001, herders are now known to chase individual antelope on motorcycles for half an hour or so until the animal stops from exhaustion, at which point the antelope is stabbed with hunting knives. Furthermore, small numbers of organized antelope poaching rings with trucks and high powered rifles still operate in the Chang Tang. As a by product of the shahtoosh trade, the heads of male Tibetan antelope with their long horns can now be seen on sale in downtown Shigatse and elsewhere, where they are sold for about US \$25 each to tourists to be used as wall trophies, in spite of the species being fully protected under Chinese law (Photo 22).

Poaching of wild yaks and Tibetan wild ass for meat by both subsistence and commercial hunters also continues in the reserve, as well as by herders seeking to safeguard their domestic yak herds and grass resources. By the late 1990s, the wild yak had been eliminated from much of its original range, which formerly spanned the Tibetan plateau, but which is now no longer found in most areas inhabited by livestock herders. As of 1998, there were only an estimated 15,000 wild yaks left in remote parts of the Tibetan Plateau, however, with the ban on hunting, wild yaks now appear to be reoccupying southern grasslands from which they had been driven by livestock operations in recent decades (Schaller 1998a, Schaller et al. 2005).

The Tibetan wild ass was also hunted extensively for meat during the famine of the late 1950s and early 1960s. Today, though numbers of wild ass are increasing in the reserve, wild ass continue to be hunted for both meat and to eliminate this animal as a competitor of domestic livestock for limited grass resources in the southern Chang Tang. Meanwhile, just this year it has been discovered that male Tibetan wild ass are now being poached for their penises, which are believed to increase male virility when eaten.

While brown bears and Asiatic black bears are hunted extensively for their gallbladders elsewhere in China, this trade is not now believed to be a major motivating factor for the killing of Tibetan brown bears in the Chang Tang at the present time. As with snow leopards, the killing of Tibetan brown bears in the study area is believed to be occurring primarily to retaliate for or prevent conflict and economic loss caused by these animals, with sale of bear and snow leopard parts only being a by-product of these killings.

9.2 Destructive Economic Development

Although Tibetans have lived in harmony with nature for centuries, this balance is now being challenged by increasing human populations and widespread development activities in Tibet, such as environmentally damaging mining and construction projects. Human and livestock populations

in the Chang Tang region have doubled since the 1960s due to the expansion of the animal husbandry sector and the general improvement of healthcare services, and in some townships populations have tripled. The Chang Tang region's most productive pasture lands, which are also the region's best wildlife habitat, are now occupied by herders and their livestock, while the Chang Tang's wild animals have been, in large part, displaced to more marginal habitat in the drier northern Chang Tang.

Although mining operations were banned in the Chang Tang and Seling Lake reserves in 2005, the damage caused by these mines remains. While the amount of habitat directly destroyed by mining operations in the reserve has been minimal, much habitat disturbance from these mine sites is indirect. This disturbance includes runoff and erosion from mine sites that muddy nearby streams and rivers and countless new jeep tracks created to access these mines, which have damaged large tracts of fragile grasslands and opened vast new territory to herders, poachers, and tourists. According to local reports, many miners were also some of the biggest subsistence hunters in the reserve, hunting wild yak, Tibetan wild ass, and other wildlife to supply their meat needs.

9.3 Lack of Funding for Reserve Management

In 1999 the Tibet Forestry Bureau developed a long term management plan for the Chang Tang and Seling Lake Nature Reserves which created a unified system of reserve offices and ranger patrols. Today, there are now seven reserve bureau offices at the county level and two reserve bureau offices at the prefecture level that are directly under the supervision of the Tibet Forestry Bureau and carry out all conservation actions in the reserves. Unfortunately, however, these bureau offices were established with insufficient funding and trained personnel to carry out the enormous task put before them of protecting wildlife throughout the vast Chang Tang and Seling Lake reserves. Presently, county bureaus have annual budgets of only about US \$6,250 per year to pay salaries and carry out all reserve management activities, and many current employees do not have any formal education or training on conservation and environment issues. Thus, the ability of the staff to effectively carry out conservation work in the TAR's Chang Tang region is severely limited, with some reserve staff having to borrow vehicles from other government agencies in order to conduct their work. Therefore if the state of wildlife conservation in these reserves is to improve dramatically, increased sources of funding will need to be found.

Part X. Key Survey Findings and Discussion

10.1 Key Findings

The following are the key findings of the April 2006 WWF Human-Wildlife Conflict Survey and data review:

A. Socio-Economic Findings:

- The use of permanent houses by nomadic herders has increased dramatically in recent years, to the point where only 6 percent of surveyed families live year-round in tents, while 46 percent spend the entire year in permanent houses and 48 percent of households divided their time between both tents and houses.
- 32 percent of surveyed households live alone, in isolation from their nearest neighbor.
- 25 percent of surveyed households considered themselves to be poor, while 63 percent considered themselves to be middle-class and only 12 percent considered themselves to be rich.

B. Human-Wildlife Conflict Findings:

The four primary types of wildlife conflict affecting herders in the survey area are as follows:

- Tibetan brown bear, snow leopard, wolves, lynx, and fox killing sheep, goats and other domestic animals both in corrals and on open pasture lands;
- Brown bears ransacking herders' cabins and tents in search of food, badly damaging or destroying homes and furnishings in the process;
- Loss of important grass resources to large herds of widely migrating Tibetan wild ass, Tibetan antelope and Tibetan gazelle, particularly in pastures reserved by herders for winter grazing of domestic livestock, possibly leading to winter starvation of livestock;
- Driving off of domestic female yaks by wild yak bulls in search of harems.

Other human-wildlife conflict findings included:

- 87 percent of surveyed households reported having experienced some form of wildlife conflict since 1990.
- The Tibetan brown bear was by far the largest source of wildlife conflict, affecting 49 percent of surveyed households, followed by grazing competition conflict with a variety of wild ungulates, which affected 36 percent of surveyed households. Snow leopard conflict affected an unexpectedly large 24 percent of surveyed respondents.
- The type of wildlife conflict a household was likely to experience was primarily a function of location, with Shenzha County having the largest bear and snow leopard problems, Tsonyi County having the largest fox and wild yak problems as well as the second largest bear problem, while Nyima County, with its large Tibetan wild ass population, had by far the largest grazing competition problem as well as the only lynx conflict problem in the survey area.
- Wildlife conflict cut across all three socio-economic factors examined in the survey: residence type, size of

living group; and self-assessed economic status, which was largely a function of herd size. Thus these factors did not appear to play a large part in determining a household's likelihood of experiencing human-wildlife conflict.

- When broken down into three 5 to 6 year time periods between January 1990 and April 2006, a dramatic increase in wildlife conflict between the first time period and the final time period was seen, ranging from a 2.6-fold increase in fox conflict to a 5.5-fold increase in snow leopard conflict. The most dramatic increases in conflict during this period occurred after 2001, probably as a result of the program to confiscate all weapons and traps in the Chang Tang and Seling Lake reserves which began in that year. Effects of this program are now being seen, with wildlife numbers increasing, wildlife becoming more habituated to human presence, and large predators increasingly seeking out human sources of food.
- Though not the most numerous wild ungulate in the Chang Tang, the Tibetan wild ass is perceived to be the largest source of grazing competition conflict, possibly because they appear at times in herds numbering

500 animals. Wild yaks are not considered a major source of grazing competition, but are considered by many herders to be as dangerous as brown bears and also one of the largest sources of economic loss to their victims, since males are known to drive off large numbers of domestic female yaks annually.

- Surveyed herders' largely uninformed responses to survey questions concerning threats to bears, causes of and solutions to wildlife conflict problems, and reasons for protecting wildlife indicate a dire need for a region-wide education program to teach herders wildlife conservation awareness and methods for preventing and mitigating the impact of human-wildlife conflict on their livelihoods.
- County data reveal that the total economic losses to herders experiencing human-wildlife conflict have increased steadily since the late 1990s, with exceptionally large increases in all forms of losses, such as livestock killed or driven off, foodstuffs lost, and dwellings damaged, occurring between 2004 and 2005.
- In the eight-year period between 1998 and 2005, 5 herders were killed by Tibetan brown bears while 2

herders were killed by wild yaks in the counties of the Chang Tang and Seling Lake Nature Reserves.

- Undocumented retaliatory killing of wildlife by herders experiencing human-wildlife conflict, in all likelihood, now rivals commercial poaching as the largest threat to the continued survival of the Chang Tang region's large fauna.

10.2 Discussion

While commercial poaching remains a large threat to the continued survival of the Chang Tang region's large fauna, through improved law enforcement efforts since the late 1990s the level of poaching, particularly of the Tibetan antelope for the illegal shahtoosh shawl trade, has been greatly reduced, and populations of all large fauna in the Chang Tang are believed to have increased somewhat in recent years. However, at the same time, all forms of human-wildlife conflict involving the Chang Tang's large predators and wild ungulates has soared to an alarming degree in the TAR, so much so that the undocumented retaliatory killing of the Chang Tang's wildlife by individual herders attempting to protect their property and livelihoods is now believed to rival poaching as the largest threat to the continued survival of many of the Chang Tang's large mammal species.

While the impetus behind these killings is the protection of livestock, property, and pasture resources, once killed, many of these animals undoubtedly find their way on to the black market for wildlife products, particularly bear, snow leopard, and Tibetan antelope parts, though there also remains a large market for wildlife meat in western China's bazaars.

Thus, if the Chang Tang and Seling Lake Nature Reserves are to fulfill their purposes of protecting the unique faunal assemblage of the north-western Tibetan Plateau in perpetuity, it is imperative that strategies to mitigate, reduce, and eliminate human-wildlife conflict issues in the region be developed immediately. At present Tibetan brown bears are considered to be the single largest source of human-wildlife conflict in the northwestern Chang Tang region, killing livestock, severely damaging homes and furnishings, raiding human food supplies, and occasionally attacking herders. While not entirely applicable to the steppe-dwelling, nomadic herding society of the Chang Tang, many national, state, and provincial government agencies in the United States and Canada have long experience in dealing with human-bear conflict issues, particularly with the grizzly bear (*Ursus arctos horribilis*) - a close cousin of the Tibetan brown bear (*Ursus arctos pruinosus*) - and a review of the diverse bear conflict reduction and personal safety strategies

developed by these agencies for grizzly bears would no doubt be an excellent point of departure for developing similar strategies for assisting herders in the Chang Tang. Such strategies include improved food, garbage, and animal feed storage practices; training dogs to keep bears away from ranches; training outdoorsmen in the use of bear spray and on what to do if they encounter a bear; tagging and relocating problem bears; aversive conditioning - e. g. scaring bears with air horns or non-lethal rubber bullets; as well as livestock relocations and creation of compensation funds. (Augustyn 2001, IYGBDAT 2002, Johnson 2006, MELP 1998, Moody et al. 2005, Wilson et al. 2006).

After brown bears, wild yaks pose the next biggest threat to herder safety and can cause devastating economic losses to herding households, as in the case of one herder who had all six of his female yaks driven off by a wild yak bull, never to be seen again (see sub-section 6.5). Thus strategies for improving vigilance and protection of domestic yak herds need to be worked out to prevent herders from carrying out retaliatory or pre-emptive killings of rare wild yak bulls. Domestic yaks live little differently than wild yaks, requiring little care and living on unfenced pastures, unsheltered and often unattended for days at a time, though generally living on lowland plains closer to human settlements than mountain dwelling wild yaks. Therefore strate-

gies to reduce conflict with wild yaks will probably require increased vigilance over domestic yak herds and moving female domestic yaks to pastures far from areas known to be inhabited by wild yak bulls, particularly during mating season (for notes on the effectiveness of guarding livestock see Distefano 2004).

The problem of snow leopard predation on livestock has emerged as a large issue for herders in the survey area in just the past 5 years, with snow leopards killing livestock on pasture lands and also entering sheep pens at night, occasionally killing 50 to 80 sheep at one time in events referred to as "surplus killings" (Jackson 1998). Strategies developed elsewhere for dealing with snow leopard predation of livestock have included improving livestock corral design to keep snow leopards out; setting aside remote pastures for the exclusive use of wild ungulates, such as blue sheep, to maintain the wild prey base of snow leopards; and creation of livestock insurance programs and compensation funds (Mishra et al. 2003, McCarthy and Chapron 2003, ISLT 2006, Jackson et al. 2001, WWF 2003). These actions, if implemented, will also reduce predation on livestock by wolves, lynx, and fox. Another simple strategy that might also reduce nighttime livestock kills by these four predator species would be to simply erect a tall, high quality steel fence enclosing corral and residential compounds, although

such a fence might be destroyed by bears and materials to build such fences are not currently available in the Chang Tang region. Increased herder vigilance would no doubt also reduce livestock kills by these predators.

Possible strategies for reducing grazing competition with the Tibetan wild ass in the Chang Tang and Seling Lake Nature Reserves are limited, and primarily involve heightened year-round vigilance at winter pastures to keep wild ass away. While another possibility might be to fence off winter pastures to keep wild ass out, fencing is expensive and is known to have a severe deleterious impact on both wildlife and pastures, and is therefore not recommended.

Part XI. Recommendations

The following actions are recommended by the authors to address the issue of human-wildlife conflict and reduce the retaliatory killing of wildlife by herders in the Chang Tang region:

11.1 Mitigative Actions

- Establish compensation programs for victims of human-wildlife conflict.
- Provide free health care to victims attacked by wildlife and pensions for those who are disabled in these attacks.

11.2 Preventative Actions

- Conduct herder trainings on methods for reducing wildlife conflict and safeguarding personal safety when encountering bears.
- Implement a corral improvement program.
- Provide portable bear-proof food storage containers.

- Investigate the possibility of training Tibetan shepherd dogs to repel bears and other predators.
- Relocate livestock from areas of exceptionally high incidence of human-wildlife conflict.
- Encourage increased vigilance over winter pastures, domestic yak herds, and other livestock.
- Provide herders with bear spray on a trial basis.

11.3 Administrative Actions

- Standardize human-wildlife conflict record keeping in reserve counties and townships.
- Research marketing of wildlife products produced as a result of retaliatory killings by herders and increase monitoring of illegal markets for wildlife products.
- Implement a region-wide wildlife conservation education program for both herders and students.
- Develop educational programs emphasizing improved

rural primary education, vocational training, small business development, and general health education with the goal of increasing occupational alternatives to livestock herding in the survey area.

11.4 Scientific Research

- Expand research efforts in the Chang Tang and Seling Lake Nature Reserves to include systematic population surveys of all predator, ungulate, and small prey species.
- Conduct further research on the root causes of human-wildlife conflict in the Chang Tang region and on the impact of this conflict on both the region's herders and wildlife.
- Develop a GIS data base containing information on wildlife movements, the location of herding camps, and the locations of human-wildlife conflict incidents.

Part XII. Conclusions

The Chang Tang and Seling Lake Nature Reserves were created in 1993 to protect an extraordinary, globally unique, assemblage of large fauna that includes the endemic Tibetan antelope, Tibetan wild ass, Tibetan brown bear and wild yak. In spite of the Chang Tang's low productivity alpine steppe ecosystem and harsh environment, large herds of wild ungulates and their predators thrived there for millennia until permanent settlement of the region by man beginning in the 1960s. At this time the assault on the Chang Tang's wildlife began, first with the slaughter of Tibetan wild ass and wild yak for meat during the famine of the early 1960s, and later with the slaughter of Tibetan antelope for the shahtoosh trade in the 1980s and 1990s. While these two problems were, in large part, reigned in by the creation of the Chang Tang and Seling Lake reserves and the subsequent hunting ban and firearms confiscation program, a new and unanticipated threat to the Chang Tang's wildlife has emerged in the past five years as a direct result of these wildlife protection initiatives - that of increased human-wildlife conflict and the retaliatory killing of the wildlife involved. With growing numbers of humans and their livestock occup-

ying these reserves, the simultaneously increasing numbers of bears, snow leopards, and other predators have become emboldened and are now increasingly conditioned to and reliant on human sources of food for their survival. At the same time, expanding herds of wild ungulates that are no longer openly hunted are reoccupying the Chang Tang's more productive southern grasslands, from which these wild herds had largely been driven at the end of the 20th century, causing growing competition for grass resources between wild and domestic herds.

As a consequence, the incidence of conflict between herders and wildlife has soared in the past 5 years, inflicting at times great economic losses on the herding households victimized by this conflict. Thus, based on widespread second-hand accounts and the growing number of wildlife remains being confiscated from herders by reserve rangers, it is believed that the largely undocumented retaliatory killing of wildlife by herders now rivals commercial poaching as the greatest threat to the continued survival of the Chang Tang region's large fauna. Therefore it is urgent that measures be taken to address the issue of human-wildlife conflict. While herders single out brown bears as their single most serious wildlife problem, conflict between humans and wildlife involves nearly all large predators and ungulate species in the reserve. As the widespread return of

wildlife to suburban America in recent years has shown, it is possible for humans and many wildlife species to coexist with minimal conflict, however much work will be required before a similar balance is achieved in the Chang Tang (DeStefano 2003).

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Appendix 1: List of Key Mammal and Bird Species Found in the Chang Tang

English Name	Latin name	CITES Appendix Listing	China Red List Category ^①
I. Mammals			
Black-lipped pika	<i>Ochotona curzoniae</i>		
Blue sheep	<i>Pseudois nayaur</i>		V
Desert cat	<i>Felis bieti</i>	II	E
Eurasian badger	<i>Meles meles</i>		
Himalayan marmot	<i>Marmota himalayana</i>		
Lynx	<i>Felis lynx</i>	II	V
Pallas's cat	<i>Otocolobus manul</i>	II	V
Red fox	<i>Vulpes vulpes</i>		
Sand fox	<i>Vulpes ferrilata</i>		
Snow leopard	<i>Uncia uncia</i>	I	E
Tibetan antelope	<i>Pantholops hodgsoni</i>	I	E
Tibetan argali	<i>Ovis ammon hodgsoni</i>	I	E
Tibetan brown bear	<i>Ursus arctos pruinosus</i>	I	E
Tibetan gazelle	<i>Procapra picticaudata</i>		V
Tibetan wooly hare	<i>Lepus oiostolus</i>		
Wild ass	<i>Equus kiang</i>	II	V
Wild yak	<i>Bos mutus</i>	I	V
Wolf	<i>Canis lupus</i>	II	V

Human-Wildlife Conflict in the Chang Tang Region of Tibet

English Name	Latin name	CITES Appendix Listing	China Red List Category ^①
II. Birds			
Bar-headed goose	<i>Anser indicus</i>		
Bearded vulture	<i>Gypaetus barbatus</i>		E
Black-necked crane	<i>Grus nigricollis</i>	I	E
Cinereous vulture	<i>Aegypius monachus</i>		V
Common kestrel	<i>Falco tinnunculus</i>	II	
Himalayan griffon	<i>Gyps himalayensis</i>	I	E
Pallas's fish eagle	<i>Haliaeetus leucoryphus</i>		V
Pallid harrier	<i>Circus macrourus</i>		
Ruddy shelduck	<i>Tadorna ferruginea</i>		
Saker falcon	<i>Falco cherrug</i>		
Steppe eagle	<i>Aquila nipalensis</i>		V
Tibetan snow cock	<i>Tetraogallus tibetanus</i>	I	
Upland buzzard	<i>Buteo hemilasius</i>		V

①CITES "Appendix I" includes all species threatened with extinction which are or may be affected by trade. CITES "Appendix II" includes all species which although not necessarily now threatened with extinction may become so unless trade in specimens of these species is subject to strict regulation in order to avoid utilization incompatible with their survival. China Red List categories are from Wang 1998, the "China Red Data Book of Endangered Animals": E (Endangered); in danger of extinction; V (Vulnerable); likely move into the endangered category; R (Rare); at risk with small population; I (Indeterminate); known to be endangered, vulnerable, or rare but where there is not enough information for an exact classification.

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Appendix 2: Human-Wildlife Conflict Survey Questionnaire

Survey Questionnaire for the April 2006 WWF Human-Wildlife Conflict Study in the Chang Tang

Date: _____

Questionnaire No. _____

Part One: Basic Information about the interviewee

1. Name _____; Age _____; Sex Male Female; Education _____
2. County _____; Township _____; Village _____
3. Number of family members _____; Household economic status _____

Part Two: Livestock and living arrangement

4. Number of livestock: A) Sheep _____
B) Goat _____
C) Yak _____
B) Horse _____
5. Living arrangement: A) House _____; B) Tents _____
6. Living unit: A) Summer: in group _____ (#of HH);
Individual _____
B) Winter: in group _____ (#of HH);
Individual _____
C) Spring: in group _____ (#of HH);
Individual _____
D) Fall: in group _____ (#of HH);
Individual _____

Part Three: Experience of conflict with wildlife

7. Have you or your family member experienced conflict since 1990: Yes; No
If yes: A) What type: _____

Human-Wildlife Conflict in the Chang Tang Region of Tibet

- (1) Brown bear attack;
 - (2) Wild yak attack;
 - (3) Wolf attack;
 - (4) Fox attack;
 - (5) Snow leopard attack;
 - (6) Pikas destroying pasturelands;
 - (7) Grazing competition with:
 - (a) Kiang;
 - (b) Antelope;
 - (c) Gazelle;
 - (d) Other;
 - (8) Other
- B) When _____ (day/night time)
- C) How (description of the conflict)
- D) Losses suffered
- E) Herder's response to the incident;
- F) Why did this incident happen?
- (1) Human moved into animal habitat;
 - (2) Lack of prey;
 - (3) Too many wild animals
 - (4) Poor quality of sheep pens and houses;
 - (5) Over grazing;
 - (6) Negligent herding practice;
 - (7) Other
- G) Did you receive any compensation?; yes ; no
- If yes, (1) what kind?
- (2) how much?
- (3) from whom?

Part Four: Solutions to wildlife conflict

8. What are solutions to wildlife conflict issues do you recommend?

Human-Wildlife Conflict in the Chang Tang Region of Tibet

- A) Killing of wild animals;
- B) Moving to a different place;
- C) Improve sheep pens and houses;
- D) Fencing of grazing land;
- E) Avoiding wild animal herds;
- F) Compensation
- G) Understanding wildlife habits (such as migration);
- H) Other;

Part Five: Conservation awareness

9. Conservation awareness

- A) Are you aware of wildlife protection laws? Yes; No;
If yes; what animals are protected in the Chang Tang?
List:
- B) Is there a penalty for killing wildlife? Yes; No
- C) Have you or your family members attended any conservation awareness programmes? Yes; No;
If yes, what type of programmes _____
- D) Why should wildlife be protected?
- (1) To improve future hunting;
 - (2) Scientific study;
 - (3) For enjoyment (decorating the grassland)
 - (4) To maintain ecological balance;
 - (5) Genetic resources;
 - (6) For future breeding;
 - (7) To sell to zoos;
 - (8) Other

Part Six: Retaliation Killing

10. Did you or your fellow villagers kill any wild animals that attacked livestock or herders? Yes; No;

- If yes, (1) What type of animal?
(2) When?
(3) How?
(4) Any penalties for this killing?

Part Seven: Traditional method of reducing conflicts

11. What are the traditional methods of reducing human-wildlife conflicts or negative impacts of conflict?

Method one:

Method two:

Method three:

Tibetan Brown Bear Questionnaire

1. Are there bears in the vicinity of your camp or community?
2. If so, how many?
3. Single bears or mother with young?
4. How many young?
5. How do you know?
 - a. I've seen them;
 - b. Household member has seen them;
 - c. Have seen tracks;
 - d. Have seen feeding sign, e. g pika and marmot burrows dug up;
 - e. Have seen bear feces;
 - f. Have seen dens/burrows;
 - g. Have seen bear damaged property;
 - h. Have seen other sign.
6. How often have you seen bears?
_____ times in the last year.
7. How often have you seen bear sign?
_____ times in the last year.
8. What do you think is the relative abundance of bears in your area:
 - a. Today: rare/fairly common/abundant.
 - b. 10 years ago: rare/fairly common/abundant.
9. Do you think the population of bears is increasing or decreasing in your area?
10. What are the threats to bears:
 - a. Humans killing them to protect:
livestock;
property (e. g. tents, houses etc.);
themselves.
 - b. Humans killing them for sale
 - c. Lack of food

Human-Wildlife Conflict in the Chang Tang Region of Tibet

- d. Extreme climate
 - e. other
11. How far apart are bears or bear families spaced?
12. Are bears and bear sign seen most often on the:
- a. Open steppe
 - b. Mountains
 - c. Equal number of sightings on both types of terrain

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Snow Leopard Questionnaire

1. Are there snow leopards in the vicinity of your camp or community?
2. If so, how many?
3. Single snow leopards or mother with young?
4. How many young?
5. How do you know?
 - a. I've seen them;
 - b. Household member has seen them;
 - c. Have seen tracks;
 - d. Have seen scrapes;
 - e. Have seen snow leopard feces;
 - f. Have seen sprays (urine);
 - g. Have seen feeding sign, e.g. killed himalayan blue sheep (nawa) or livestock;
 - h. Other sign.
6. How often have you seen snow leopards?
_____ times in the last year.
7. How often have you seen snow leopard sign?
_____ times in the last year.
8. What do you think is the relative abundance of snow leopards in your area;
 - a. Today: rare/fairly common/abundant.
 - b. 10 years ago: rare/fairly common/abundant.
9. Do you think the population of snow leopards is increasing or decreasing in your area?
10. What are the threats to snow leopards;
 - a. Humans killing them to protect:
 - livestock;
 - property;
 - themselves;

Human-Wildlife Conflict in the Chang Tang Region of Tibet

- b. Humans killing them for sale;
 - c. Lack of food;
 - d. Extreme climate;
 - e. other;
11. How far apart are snow leopards spaced?
12. Are snow leopards and sign seen ever seen on the open steppe?

Human-Wildlife Conflict in the Chang Tang Region of Tibet

Appendix 3: English, Chinese, and Tibetan Place Names

Amdo	安多	ཨ་མདོ།
Asur	阿苏	ཨ་བུ་ར།
Chang Tang	羌塘	ཕྱང་ཐང་།
Chuntsang	军仓	རྩེ་ཆང་།
Dargo	达果	དང་རྒྱ།
Dongru	东汝	གླང་རུ།
Dongtso	洞措	ལྷོ་མཚོ།
Drakbu	察布	བླ་བུ།
Drongtsang	中仓	འབྲོང་ཆང་།
Dronyi	卓尼	ཐོ་ནི།
Drowa	卓瓦	འབྲོ་བ།
Gegyal	革吉	དགེ་རྒྱ།
Gertse	改则	གེ་རེ།
Gumu	古木	གུ་མུ།
Jago	甲谷	རྩ་ཁུ།
Jeewa	吉瓦	རྒྱ་བ།
Laido	来多	ལེགས་གཏོར།
Maibe	买巴	མུ་པ།
Nagchu	那曲	ནག་ཆུ།
Ngari	阿里	མངའ་རྒྱ།
Nyima	尼玛	ནི་མ།
Parling	巴岭	པ་ར་ལོང་།
Pelgun	班嘎	དཔ་ལ་མགོན།
Rongma	荣玛	རོང་མ་མར།
Rutok	日土	རུ་ཐོག་
Seling Lake	色林措(湖)	ཤེ་ལིང་མཚོ།
Shenya	申亚	ཤེང་ཡ།
Shenzha	申扎	ཤེན་མ། ཤེ་མ་མ།
Shide	协德(和平)	ཤེ་བདེ།
Shigatse	日喀则	གཤིས་གཟེ།
Tso Lho	北措折	མཚོ་ལྷ།
Tsonyi	双湖	མཚོ་གཉིས།
U'chu	俄久	འུ་ཅུ།
Wenbu	文布	འུ་བུ།